Railway Age Gazette

PUBLISHED EVERY FRIDAY AND DAILY EIGHT TIMES IN JUNE BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY
WOOLWORTH BUILDING, NEW YORK

CHICAGO: Transportation Bldg. CLEVELAND: Citizens' Bldg.
LONDON: Queen Anne's Chambers, Westminster.

E. A. SIMMONS, *President*
L. B. SHERMAN, *Vice-President* HENRY LEE, *Sec'y & Treas.*
The address of the company is the address of the officers.

EDITORS
SAMUEL O. DUNN, *Editor*
ROY V. WRIGHT, *Managing Editor*

W. E. HOOPER	H. F. LANE	R. H. WHITE
B. B. ADAMS	R. E. THAYER	C. W. FOSS
E. T. HOWSON	A. C. LOUDON	F. W. KRAEGER
H. H. SIMMONS		GEORGE L. FOWLER

Subscriptions, including 52 regular weekly issues and special daily editions published from time to time in New York, or in places other than New York, payable in advance and postage free:

United States and Mexico	$5.00
Canada	6.00
Foreign Countries (excepting daily editions)	8.00
Single Copies	15 cents each

Engineering and Maintenance of Way Edition and four Maintenance of Way Convention Daily issues, North America, $1.00; foreign, $2.

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

WE GUARANTEE, that of this issue (the monthly Engineering & Maintenance Edition) 11,050 copies were printed; that of those 11,050 copies, 7,388 were mailed to regular paid subscribers to the weekly edition; 1,926 to subscribers who get the Engineering & Maintenance Edition only, 250 were provided for counter and news companies' sales, 1,187 were mailed to advertisers, exchanges and correspondents, and 299 were provided for samples and office use: that the total copies printed this year to date were 186,850, an average of 9,343 copies a week.

VOLUME 56 MAY 15, 1914 NUMBER 20

Contents

The safety-first movement has made progress according as the officers *and* the rank and file have spread its gospel.

Safety-First Habit Demands Study

Unless every employee who is capable of imparting his own spirit of caution to other employees does actually do something in that line the movement will fall far short of its best results. But this is often difficult. A superior can give advice easily, if he knows how; but the nearer two employees come to being equals, the harder it is for one to advise the other. This is called to mind by a recent article in the Chicago, Milwaukee & St. Paul Employees' Magazine, by Henry Driscoll, a conductor on that road in the state of Washington. Mr. Driscoll says:

> The safety first movement must be promoted along educational lines; the old engineer and old conductor are the very men needed. There is need of your counsel and the true story of your experience; tell the less experienced of the traps and pitfalls of the business; take the young fellow aside and whisper a word of warning—it may do a power of good.

How is this to be made easy? For one thing, by inducing the less experienced to *desire* the advice of the older heads. To cultivate this desire it is usually necessary to begin back, in the fundamentals; get the thoughtless employee to explore the subject from any and every angle. Mr. Driscoll offers the very practical suggestion that every trainman should read the comments of the Interstate Commerce Commission, on safety, in its last annual report. This and other extracts from his article are reprinted on another page. This article is commendable for two things: the author talks frankly to his fellow trainmen concerning faults on the inside, evading nothing; and he seeks authentic sources of information on the outside. The Interstate Commerce Commission report was based mainly on one or two collisions, and it does not tell everything; but it should set trainmen to thinking. Mr. Driscoll believes that nine-tenths of his fellow employees are ignorant of what the government is doing to promote safety.

Iowa had the unenviable distinction of being the one state which suffered a net loss of population between 1900 and 1910.

Where Demagogues Accumulate and Population Decays

Statistics recently made public by the Bureau of the Census show that the decline of the state's population has continued up to the present. As was lately remarked in these columns, Iowa has forged ahead of Kansas in the procession of those commonwealths which devote themselves chiefly to devising cruel and unusual punishments for the capitalists who venture to invest within their boundaries. Iowa ought to have more distance state freight rates. It ought to have more civic organizations like the Greater Des Moines Association to hammer down interstate railway rates. It has Messrs. Cummins and Kenyon in the senate to advertise the state's profound antipathy to the development of railways by private companies and its growing sentiment for government ownership; and it ought to fill its delegation in the House of Representatives with statesmen of the same kind. It has Clifford Thorne on its state railroad commission to appear as counsel for shippers' organizations before the Interstate Commerce Commission and to compile barrels of statistics misrepresenting railway operation and its results in every detail; and it ought to put two more men of the same type on its state railroad commission. Having made these improvements in its state and interstate freight rates, in its civic organization, in its delegation in Congress and in its railroad commission, Iowa doubtless would be able to accelerate the downward tendency of its population until soon there would be left in the state no men of thrift, no men with old-fashioned ideas regarding the rights of property, no men with the antiquated notion that producers have the same right as demagogues to compensation for the services that they render. "Ill fares the land to hastening ills a prey," where demagogues accumulate and industry and population decay. It is

notable, in this connection, that the population of Iowa steadily increased until the decade beginning with 1900; and that the present reign of the radicals began with the election of A. B. Cummins as governor in 1902, and that the decline in population has proceeded steadily since that time. We commend Iowa's experience to the study of other states which may have ambitious Cumminses, Kenyons and Thornes in their midst.

SOUTHEASTERN RATES AND THE FOURTH SECTION

THE report of the Interstate Commerce Commission on fourth section violations in the southeast is one of more than usual interest to shippers and carriers in all that portion of the United States lying south of the Ohio and Potomac rivers, and east of the Mississippi river.

The report deals with rates on both classes and commodities from New York, Cincinnati, Louisville, Chicago, Cairo and St. Louis, to coast, river and interior points throughout the whole southeastern section. The various southeastern railroads, through their applications, sought authority to continue lower rates from all these points of origin to the destinations than to intermediate points on direct lines, and therefore, the report is a very complicated one and will require a great deal of time to digest. The rate situation in the southeast is one of long standing and of peculiar complexity. The advantage which a city possesses by reason of its location upon navigable water which affords a cheap means of transportation for its articles of commerce, has been recognized by the carriers in the adjustment of their rates, and this principle has been recognized by the commission in its report.

The commission has recognized the force of both actual and potential water competition by granting relief with respect to rates from New York and the Ohio river crossings to the south Atlantic and gulf ports, and with respect also to rates from St. Louis, Cairo and Chicago to gulf ports and Mississippi river points, authorizing the carriers to continue rates to these points lower than to intermediate points. To this extent, therefore, the commission has sustained the general plan of rate-making prevailing in the southeast which has been in effect ever since through railway transportation has been in existence, and in the twelve subdivisions into which the commission has divided its report, it has repeatedly recognized the fact that the lower rates necessitated are sub-normal. The commission also sustains the contention of the carriers that while these rates are low, they still pay something more than the additional cost of the traffic and do not add to, but subtract from, the burden borne by the intermediate stations with higher rates. In some cases, however, the commission finds the intermediate rates too high, as judged by comparison with a mileage scale of rates derived from an average of many rates made to non-competitive points in the same general territory, and therefore unduly discriminatory.

The commission holds, however, that relief from the provisions of the fourth section should not be granted on account of the desire of the carrier to reduce the rate to a given market of distribution in order to facilitate the distribution of articles from that point in competition with another point distributing the same or similar articles, and that relief may be granted to a carrier that is transporting a commodity from one source of supply to a consuming market and coming into competition at that market with another carrier transporting the same or similar articles from a different source of supply, only when it is affirmatively shown: (a) that the carrier seeking relief is at a marked disadvantage with respect to its competitor; and (b) that the competition met at the reduced-rate point is consistently met at all intermediate points.

As to the effect of the decision, either on the rates in the southeast or upon the revenues of the carriers, it is too early for any but the most general comment. The report involves many complicated situations and a great deal of time will be required before the carriers will be able to work out the new problems presented to them, and to determine how their revenues will be affected. An idea of the magnitude of the case may be gained, however, by the statement of the commission that the total estimated losses accruing to all lines in southeastern territory brought about by rigid applications of the long-and-short-haul clause accomplished by reductions in the intermediate rates without any increase in the long-haul rates, would have been $16,026,512 for the year considered, and that assuming that the losses would bring about a like reduction on all lines the surplus of 20 lines, aggregating 3,345 miles of railway would be wiped out, and in addition three other lines of an aggregate mileage of 2,280 miles of railway would be subjected to such radical reductions as to reduce their surplus for the year to an almost negligible quantity. The commission says that it is entirely clear that the revenues of a large percentage of the lines in southeastern territory would be so impaired by such a procedure as to make it impossible for them to meet their operating expenses, taxes and fixed charges and leave to their stockholders even a moderate return. Therefore, it finds that the rate situation in the southeast presents many cases where the commission must exercise that discretion vested in it by law to relieve the carriers from a rigid application of the long-and-short-haul rule in special cases. It is apparent that the relief granted by the commission will very materially reduce the estimated loss. It is also apparent that this report, together with the reports concerning various complaints heard by the commission during the last two years respecting rates to points in southeastern territory, will have the effect in many instances of materially changing the relation of rates now existing.

WHY RAILWAYS HAVE TO CARRY THEIR CASE TO THE PUBLIC

SENATOR LAFOLLETTE, of Wisconsin, arose in his place in the Senate last week to reproach the Eastern railways for the efforts which they have made to create a public opinion favorable to an advance in freight rates. His attack was similar to that made on the roads by Senator Cummins several days previously. As we pointed out in commenting on Mr. Cummins' remarks, the need for the railways to use every legitimate means to get the facts about their business before the public has been created chiefly by muckrakers and demagogues who have misrepresented them. While Mr. Cummins has been highly effective in the labor of misrepresentation, all other public men must yield to Senator LaFollette the palm for industry and efficiency in this field of effort. Perhaps Mr. LaFollette is incapable of telling the truth about railways. Or perhaps he is merely determined not to do so. In any event, he has done more to make it necessary for the railways to carry on a campaign of education and refutation than any other public man. It is gratifying, therefore, to find him protesting against the counter efforts of the railways. It shows he sees that those efforts are bearing fruit. The more the Cumminses and LaFollettes denounce the educational work done by the railways the better satisfied the managements of the railways should be.

To readers who have not followed closely Mr. LaFollette's career the foregoing statements regarding him may seem too severe. Let them, then, consider a few facts which we shall now present. The Senator from Wisconsin has done more than any other public man to give currency to the charge that the railways of the United States are capitalized for twice what they ought to be. This charge was made by him in the Senate some years ago and has been repeated a thousand times since by him and others, without any evidence ever having been offered to support it. It is true there are American railways which are grossly overcapitalized. But there are others that are greatly under-capitalized, and on the whole they probably are capitalized for less than their mere physical value. The ablest and best informed foreign student of the railways of the United States is the English railway economist, W. M. Acworth. About 80 per cent. of the railway mileage of Argentina was built and is owned by English capital. In view of this fact a comparison of the average capitalization of the railways of the United States with the capitaliza-

tions of the leading railways of Argentina, which Mr. Acworth contributing to the London Economist of January 3, 1914, is interesting and significant. Said Mr. Acworth: "In capitalization per mile the Argentina railways are distinctly ahead. The four (large) systems range from £14,900 to £16,900 (a mile). The figure for all American lines is between £12,000 and £13,000. The Argentine railways have been honestly built for cash. The average American citizen believes that the common stock of its own railways is largely watered." Proceeding, Mr. Acworth contrasts the physical features and traffic statistics of the Argentine railways with those of the United States, and reaches the conclusion that "it is only their extraordinarily small capitalization per unit of traffic that enables the railways of the United States, with their low rates, to keep their heads above water." Whether measured by their physical condition, the volume of traffic they handle, or the official figures regarding the investment in them, the railways of the United States are the lowest capitalized railways on earth. And yet, the LaFollettes have succeeded in making most people think that they are all excessively capitalized.

Three and a half years ago, as now, the eastern railways were seeking increases in their rates. In August of that year Mr. LaFollette alleged in the Senate that the proposed increases in rates in Official Classification territory alone would increase railway earnings by $500,000,000 a year. As a matter of fact, the railways of Official Classification territory were proposing to increase only their freight rates, and to have increased their earnings $500,000,000 a year it would have been necessary for the advance in their freight rates to average 60 per cent. And yet in the same speech Senator LaFollette said that the average advance would amount to only 16 per cent!

The gentleman from Wisconsin does not improve with age. In a speech in the Senate which was published in the *Congressional Record* for October 28, 1913, page 483, he said: "In 1905 more than 10,000 passengers and more than 48,000 employees were killed on the railroads of the United States." Now, the total number of passengers killed in 1905 was 537, and the total number of railway employees killed was 3,261. In the entire ten years, 1904-1913, inclusive, the number of passengers killed was only 4,269, or 5,731 less than Mr. LaFollette said were killed in 1905 alone, and the number of employees killed in that 10 years, including those who were off duty at the time, was only 33,664, or 4,336 less than Mr. LaFollette said were killed in 1905 alone.

We could go on column after column enumerating similar statements that have emanated from Mr. LaFollette. Because of his official position he can secure widespread publicity for them. If such statements are allowed to go unrefuted—as they formerly were—the public is sure to accept them as true. Is it not, then, desirable that they shall be refuted and that the truth about all such matters shall be told so as to make it impossible for misrepresentations to take root and flourish as so many have in the past? The muckrakers and demagogues have forced the railways to use every legitimate means at their command to get the facts about their affairs before the public.

Messrs. Cummins and LaFollette charge that the publicity the railways have given to what they conceive to be the facts regarding their business and the efforts they have made to get commercial organizations to petition the Interstate Commerce Commission to grant advances in rates have been intended unduly to influence the decision of the commission. Ever since the commission was established commercial organizations have sent it resolutions and petitions, newspapers have published editorials, public men have made speeches, and individuals have written letters, whose manifest purpose was to influence the commission. Three and a half years ago the very commercial organizations that are now petitioning the commission to advance rates were petitioning it to reduce rates. Three and a half years ago, as we have seen, Senator LaFollette was making speeches in the Senate to influence public opinion and the commission. If it is right to try to influence the commission to make reductions in rates, how can it be wrong to try to influence it to permit advances in them?

Nobody except the managements of the railways ever before found any fault with efforts to create a public opinion that would influence the commission. Mr. LaFollette suggests legislation to stop these efforts on the part of the railways, shippers and others to influence the commission. A measure to prohibit all efforts to influence it except by the presentation of testimony and arguments before it, would be beneficial if it could be enforced. But if a gag law is to be passed the public's sense of fairness and decency will hardly permit it to be applied only to those who believe that railway net earnings are too small and should be increased; and no law which would put a gag in the mouths where it is most needed could be passed or enforced.

INTERLOCKING DIRECTORATES

THE bill, which has been reported to the House of Representatives by the Committee on Interstate and Foreign Commerce, contains among other provisions a section which makes it unlawful for any person to hold the position of officer or director of more than one railroad company without the approval of the Interstate Commerce Commission.

Interlocking directorates, if it means anything more than diversified business interests of individual wealthy men, means that the same individual, or individuals, acts as director in two or more corporations which are competitors. The competitive relation may be that of one railroad with another, or of buyer and seller, or railroad and banker (seller and buyer).

A man's private interests are identical with those of a corporation of which he is a director only when he is the sole director and owner of the stock, and when he has no other business. A director serving on two different railroad boards, where the railroads do not compete, is not any more likely to find that the interests of one company conflict with those of the other than that his own personal interests may conflict with his duties as a director in one of the companies. On the other hand, when a man is director in two railroad companies which serve the same territory, and which compete for either through or local traffic, he may or may not be compelled to subordinate the interests of one company to those of another. In the same way, if the same man is a director of a railroad company, and of a supply concern from which the railroad may or may not buy supplies, or is a director of a railroad company, and a member of a banking firm to which the railroad company goes when it wants to sell its securities, again the interests of the two companies may be so at variance that the director will of necessity have to subordinate the interests of one to the other.

The desirable results which have been brought about by the same man acting as director for companies whose interests are apparently antagonistic may be suggested by the phrase "community of interest." Competition carried to its logical end results in monopoly, since it is inconceivable that two or more forces will chance to be so exactly evenly balanced that neither will gain an advantage over the other. In the conflict, however, it has been the common experience that not only does the vanquished suffer irreparable injury, but the victor also has suffered a loss which must in some way be made up to him. This is so obvious, in competition between different railroads, that it needs no illustration; but it is likewise true of the competition between buyer and seller. A number of supply concerns competing for contracts from a railroad on one class of supplies which they all manufacture will possibly recoup themselves for the cost of this competition from the manufacture of inferior goods, or the charging of exorbitant prices for other supplies which they sell to the railroad, which are not subject to competition. The banking house which is awarded the contract for selling a railroad company's securities only when it has made the lowest bid, is under no moral obligation to support the railroad company when there are no bidders for its securities, and the railroad company selling its securities to any banker who will bid the highest price for them is under no moral obligation to refrain from selling additional securities to other bankers as long as it can do so without the violation of a law, even though such sale will tend to work injury to the clients of the former bankers. It was in part to avoid the waste

of this competition that interlocking directorates were formed.

The claim, however, of those who wish to prohibit interlocking directorates is that whereas the elimination of the waste of competition should have accrued to the benefit of the community as a whole, it has accrued solely to the individuals on the boards of directors, and that in addition there has been an abuse of power which has worked material injury to the other security holders of the companies, or to the public served by the companies. If Mr. Frick chooses to buy a controlling interest in the stock of one railroad, and vote his proxies to have himself elected director, and at the same time buy a controlling interest in the stock of a competing railroad and vote his proxies to have a friend of his, whom he can trust, elected a director of the second railroad, a mere prohibition of interlocking directorates will not prevent the policy of the directors in both companies being influenced by Mr. Frick's views.

Furthermore, such a law might be found to be unconstitutional. Could the federal legislature deprive the stockholder of the voting power, which belongs, according to a company's charter, to a holder of its stock? It will be noted that this is quite a different question than that involved in the Union Pacific-Southern Pacific dissolution.

After all, an individual director has only one vote in the deliberations of a board. When it comes to an actual show down his vote counts no more than that of any other director. The late J. P. Morgan's name is more often associated with interlocking directorates than any other. Mr. Morgan rarely took any part in the discussions at board meetings when he was present, so that his influence was confined very largely to the weight of his single vote, or influence brought to bear outside of the board rooms. The single vote seldom, if ever, would be the deciding vote, and his compulsory retirement from a board would not lessen the influence that he could bring to bear outside of the board room to any great extent. The influence that a man like E. H. Harriman had on a board of directors was due very largely, if not entirely, to the confidence which his associates had in his judgment, combined, of course, with the tremendous personal magnetism of the man. To a very appreciable extent the prohibition of a man's holding office on the boards of two competing railroads would lessen the possibilities of the exercise of such power as Mr. Harriman had, but would do very little to lessen the power of such a man as Mr. Morgan.

There is another matter that should be taken into consideration. Bankers originally get on to the board of directors of railroad companies, following a reorganization in which they have agreed to finance the plan under which the new company is formed. They undertake to market the securities of the new company, and they do this by selling them to their clients, who, in a large measure, depend on the judgment of the bankers rather than on their own judgment in buying such securities. The banker remains on the board of directors of the railroad company to keep an eye on the proceedings, and to see that the interests of his clients are protected. Will the fact that the banker cannot so closely follow the management of a railroad property whose securities he is called upon to sell to his clients make him less desirous of entering into this kind of business? Will he ask a higher price for his money because of the increased speculative risk which will be incurred because of his inability to follow in detail the management? Will he be willing to advance money at all to a railroad company which is in dire financial straits, where he is to have no direct voice in the management of the property while it is being rehabilitated? These are rather serious questions, especially at present when it is so much of a problem for even the strongest of the railroad companies to permanently refund maturing obligations, and to raise capital for additions and betterments to the property.

Possibly the one thing that has been detrimental to the best management of a railroad property through the influence of the bankers on its board of directors is the necessity for making a good showing at about the time that new securities are to be issued and sold, and its resulting subservience of the judgment of the operating executive to the desire of the banker. The mere fact that the banker is no longer a member of the board of directors will have very little, if any, effect on this situation. In fact, the temptation would be even stronger to make a showing at the expense of what is in the long run the most economical operation, because with the banker off the board of directors, the showing will be the only thing which he will have to go by in considering a purchase of the company's securities.

A law to prohibit interlocking directorates will be another of the long list of legislative acts which attempt to compel something by law which can only be compelled by the force of public opinion.

NEW BOOKS

Where and Why Public Ownership Has Failed. By Yves Guyot, editor-in-chief of the *Journal des Economistes*, president of the Société d'Economie Politique of Paris, former vice-president of the Municipal Council of Paris, deputy to the French Parliament and Minister of Public Works, etc., etc. 5½ in. by 8 in., bound in cloth. 459 pages. Published by The MacMillan Company, New York. Price, $1.50 net.

In few other leading countries does the government take a more active hand in industry than in France. It owns and operates two of the large railway systems. The telegraph and telephone are adjuncts of its postoffice department. It has a monopoly of the manufacture of matches. It has a monopoly of the manufacture of tobacco. These are but typical cases. And whatever the central government does not own and manage, it controls and regulates. These things have brought many persons into the employ of the public. It is estimated that one voter out of every nine in the country is in government service. The proportion is certainly not smaller; it may be larger.

In view of these facts, it is not without significance that in no other country is there developing a stronger reaction against government ownership and management than in France. The movement against it has some extraordinarily able leaders, including Clement Colson and Paul and Pierre Leroy-Beaulieu. Still another of its strong leaders is Yves Guyot, the author of this book, who speaks with especial authority on the subject of government management because he formerly was Minister of Public Works of France.

It cannot be said of M. Guyot's book that it is judicial in tone. As its title indicates, it is meant to be an attack on public ownership; and it is a vigorous, uncompromising attack. More than this, however, it is a skillful, well-directed and effective attack. Every argument against government ownership presented is supported with specific examples and statistics drawn from the experience of countries all over the world with state railways, municipally-operated public utilities, government docks and coal mines, state life and fire insurance, and so on.

The advocates of state ownership usually rely upon chiefly theoretical arguments. The state can borrow money cheaper than private corporations; therefore, government ownership will save money. The public officials will have no object but to serve the public well; therefore, the service under government ownership will be better than under private ownership. These are typical contentions. As the *Railway Age Gazette* repeatedly has pointed out, the results of public ownership of railways nowhere justify the claims made by the partisans of the policy. M. Guyot shows the same thing not only in respect to public ownership of railways, but in respect to public ownership in general. In view of the present agitation for government ownership of telephones in the United States, the evidence, largely based on personal experience, that he gives to show that the telephone service in the United States under private ownership is by far the best in the world, is especially interesting.

Space will not permit a full review of M. Guyot's book. It must suffice to say that it is one which should be read by everybody who is interested in the question of government ownership. The translation into English was made by H. P. Baker, and was read and revised by the author; and for the American edition the facts and figures were, as far as practicable, brought up to June, 1913.

Annual Convention of the Air Brake Association

Interesting Papers on Modern Train Building and the Electro-Pneumatic Signal System for Passenger Trains

The twenty-first annual convention of the Air Brake Association was held in Detroit, Mich., May 5-8, W. J. Hatch, of the Canadian Pacific, presiding. The meeting opened with a prayer by Rev. Chester B. Emmerson, and the association was welcomed to the city by the Mayor, Hon. Oscar B. Marx.

President Hatch in his address paid special tribute to the late George Westinghouse, calling attention to the wonderful example he set for the world in general and air brake men in particular.

Mr. Hatch spoke strongly in favor of some sort of an arrangement for adjusting the slack on freight cars. Whether it be automatic in its operation or whether it be operated manually he believed that a slack adjuster should be used. He favored the further investigation of the air hose problem with a view to obtaining a hose that would give better service in the extremely cold climates. In mentioning the recent depression of business he outlined the magnitude of the railway business in the United States and called attention to the opportunity which the dull times afforded to get the equipment in shape to meet the rush of business which is bound to come in the near future. Mr. Hatch also referred to the excellent results that had been obtained by the practice of terminal brake and coupler inspection which is in effect on the Atchison, Topeka & Santa Fe, and believed it was a practice that should be followed on all roads.

The secretary reported a membership of about 1,200 and a cash balance of $1,324.58.

H. H. Vaughan, assistant to vice-president, Canadian Pacific, who was present during the opening session, addressed the convention with a few extemporaneous remarks, paying special tribute to the work of this association. He expressed the opinion that the electrically controlled brake would be the means of solving many of the braking problems that are now being encountered in railroading.

On Tuesday afternoon, May 5, a Manufacturers' Exploitation Meeting was held and the members were addressed by representatives of the exhibitors on their respective products.

W. A. GARRETT'S ADDRESS

W. A. Garrett, chief executive officer, Pere Marquette, addressed the convention on the problems encountered by railway officers. He spoke as follows:

"If we are to continue to have privately owned railroads, supervised and regulated by governmental authority, and if we are to avoid ownership by the government, the owners, users and employees of the railroads must all work together. If the railroads of the country were owned by the Federal or State governments, because of insufficient net revenue at the present time to take care of the property, one of three things would happen:

The rates for transportation would have to be increased; the wages of the employees would have to be decreased; or, the government would be required to assume the deficit of the railroads through taxation.

No railroad management can succeed without the support of the public which it serves. It must never be forgotten that the railroad is a public servant, in fact as well as in name, but the service which the railroad can give must depend on the treatment which it receives from this master.

It is claimed that there has been mismanagement on some roads, but each one of you know that the morals of all kinds of business have improved year by year and things have been done by the railroads, as well as other businesses, in the development of our fast growing country, that probably were not right, and they certainly have been frowned on by both the law and public opinion. But is there anything in the situation that warrants calling a halt in the development of the railroads?

Many of the State and Federal politicians have ridden into power on an anti-railroad ticket, and yet very few politicians and very few business men at the present time are anxious to invest their savings in railroad securities. George A. Post, of the Railway Business Association, recently showed that in addition to the Federal authorities and the Interstate Commerce Commission and their many hundred assistants, the railroads have approximately 7,936 additional bosses, namely: 48 governors, 98 United States senators, 435 United States congressmen, 157 state railway commissioners, 1,700 state senators and 5,500 state assemblymen.

All American railroads need a helping hand. They want the good will of the American people. They need words of encouragement. They want the American people to look forward and help them in their onward movement, especially when it is reported that there were 141,525 idle freight cars in the United States on April 1.

The Pere Marquette is bankrupt on account of the low rates prevailing on that road. It receives 6 mills per ton of freight per mile and a maximum passenger rate of 2 cents per mile, and while the Pennsylvania pays dividends on a freight rate slightly under 6 mills and with a maximum passenger rate of 2½ cents per mile, the density of traffic is much greater, being about 6½ times greater in freight traffic and 5 times greater in passenger traffic. Of every dollar collected by the Pere Marquette during the seven months ending January 31, 1914, that road has paid out to operate the property not only the original dollar but more than a quarter of a cent more. This had to be borrowed by the receivers and there was absolutely nothing left with which to pay interest on bonds, stock or receivers' certificates. Is there any question but that the railroads need help in the form of increased rates?"

THE CABOOSE AIR GAGE AND CONDUCTOR'S VALVE

Mark Purcell, Northern Pacific, presented a paper on this subject, an abstract of which follows:

On trains controlled by air brakes, one of the chief essentials is to know that the brake pipe is properly coupled up and charged the entire length of the train, and that the pressure is under full control by the engineer. This points directly to the importance of having all cabooses equipped with reliable air gages, so the trainmen, when in the caboose, may at all times know the amount of pressure in the brake pipe, and have a means of noting the variations when brakes are applied and released, and from this, together with the knowledge gained from the car-to-car inspections made in the standing tests required by the rules, be enabled to make a close approximation of the efficiency of the brakes.

The rate of rise in pressure at the rear end of the train when charging up after the brake pipe has been cut for any cause and recoupled, and when releasing brakes after ordinary applications, failure to maintain brake pipe pressure without variation while brakes are not being operated, any considerable decrease in pressure while en route without a corresponding effect of the brakes being felt, etc., are conditions that may be promptly noted; and from the fact that they indicate danger from sliding or overheating wheels, or from the engineer not being able to properly operate the brakes throughout the entire length of the train, the trainmen are warned in time so that measures can be taken to prevent serious consequences. In fact the caboose gage places the men at the rear end of the train on an equal footing with the engineer as to knowledge of what is taking place in the air brake system. This is not only desirable, but necessary, for safe and economical operation. There are many cheap gages on the market, but they seldom render satisfactory service, and the added first cost to procure a reliable article is fully justified by the longer and better service secured.

Provision should be made on all cabooses for easily and

quickly applying brakes at times when impending danger to life or property makes it necessary to apply them from the rear, on account of the inability to make known to the engineer the need of a prompt application. The most important features in connection with this are that the valve be of sufficient capacity to cause quick action, and that it be located in an accessible place.

This valve should have the emergency feature only as providing the service application feature would quite naturally be looked upon by trainmen as an endorsement of the practice of making stops by applying brakes from the rear to avoid the inconvenience of transmitting signals to the engineer, and having the application made by means of the brake valve on the engine. It should be pointed out that, the fact of damage to equipment invariably resulting from the promiscuous use of the conductor's valve, does not permit of any excuse for using it in any other than cases of emergency.

It is our opinion that the best practical device for this purpose is a valve that can be opened quickly, and will provide a sufficient opening to insure quick action of the brakes the entire length of the train, or can be opened gradually, and a small amount, to produce a slow reduction to cause a service application, in cases of an immediate stop being necessary, and yet sufficient time available to permit of exercising care to avoid quick action of the brakes, which might, and often does, cause serious damage to the train, particularly when the quick action starts from the rear. When it is found necessary to open the conductor's valve to apply brakes on a freight train, it should be left open until the train stops.

Discussion.—Strong testimony as to the value of this equipment in the caboose was given by all the men who have been using it, and numerous instances were mentioned where on account of its installation serious wrecks had been averted. Many roads have found that the accidents thus averted have more than saved the cost of the installation of this equipment on all of their cabooses. While instances were mentioned where the controlling valve had been used for other than its intended purpose, it was believed that more careful instruction to the train crews would eliminate this trouble. Locomotive engineers stated that while they were often blamed for break-in-twos caused by the misuse of this valve, they nevertheless greatly favored its installation, as they then felt a feeling of protection from the rear. P. J. Langan, of the Lackawanna, made a strong appeal for its general application from a "Safety First" point of view. It was stated that the Canadian Railroad Commission requires its installation in all cabooses operating in Canada.

MODERN TRAIN BUILDING

A paper on this subject was read by George W. Noland, P. C. C. & St. L., an abstract of which follows:

There is an art in building up a train so as to reduce the number of switches to a minimum, and still be able to get the train or trains out on schedule time. There is too much indiscriminate switching and use of the lighter capacity equipment on the head ends of the long, heavy modern trains as they are made up at the terminals. The modern train consists of from 50 to 130 cars, and the safety of the train does not permit of too many of the older and lighter capacity cars being placed on or near the head-ends. All steel or steel underframe equipment should be given the preference in the makeup of the head ends, and especially in the solid through trains that are now being made up. This can be best brought about by giving that particular equipment the preference in loading and classification, and keeping the older and lighter cars for loading to come in the rear portion of the train. It is no uncommon sight to see a heavy train with three or four and sometimes more of the older and lighter capacity cars on the head end. This is a wrong practice and should be discontinued. Proper train building can be very easily accomplished if the yard conductor will only use a little judgment.

First you may ask the question: "Can modern methods be applied to train building?" They can, and should be practiced to the fullest extent possible, and especially in the improved terminals. The gravity or "hump" yards are particularly adapted for modern train building, also the open-end yards. One method in practice is to permit the heavy load to be hauled on the rear portion of the train, which is also very detrimental to weak draft gears.

I have in mind one case in particular which prompted me to write on this subject. The train was made up as follows: head-end, 5 empty refrigerators, steel underframe, 10 hoppers of coal, 20 empty refrigerators of the older and lighter capacity equipment, and 10 more hoppers of coal. All the hoppers in this train were of the newer and more modern equipment. This train was held out of the yard for considerable time, waiting for track room, and had to have help to get into the yards. The upgrade on which the train was stopped was 1½ per cent.; the tonnage was 1,850 tons. In the effort to start the train there was a separation at the twelfth car from the rear end, in the older and inferior equipment. It was not the drawbar alone that pulled out, but the draft timbers and part of the end of the car came along with it. The tonnage of the twelve cars that were back of the separated portion was 746 tons, which was over one-third the entire weight of the train. It is not surprising that the break-in-twos occur, when trains are built up in this way.

This train could have been much more safely built up, had the conductor only used a little judgment and thrown those heavy loads on the head end. This would have placed 25 of the more modern cars on the head end, where it belonged, and it would not have affected the classification of the train in the least.

Another case was an 80-car double-header. The make-up of the train was as follows: 10 hoppers of coke, steel equipment; 20 empty box cars, steel underframe; 15 empty stock cars, 50,000 lb. capacity; 5 hoppers of coal, steel equipment; 20 empty refrigerators, older and lighter equipment; 10 hoppers of coal, steel equipment. There were three separations in this train while pulling into the terminal. Two of them occurred in the refrigerators, and one in the stock cars. The first separation occurred in the stock cars, and when the sudden lurch backward on the rear portion came, the other two separations occurred, considerable damage being done to the equipment. With a little good judgment, that train could have had 45 cars of the more modern and improved equipment on the head end and lessened the chances of a triple separation; and it might have gone over the road without a mishap.

There is never a track so full of cars that there cannot be room enough left to place a few of the cars on the rear end. Arrangements can always be made for such emergencies. In most all cases the conductor has advance information in regard to the train he is about to switch, and he can arrange his work accordingly. I might add that with two extra switches that double-header could have been made far safer than in its original makeup.

An example of what should be done is that of a double-header, consisting of 41 loads, all steel equipment. It was suggested on this train to cut out two of the older and lighter capacity cars, and set them on the rear of another train of the same classification, which was done. The actual time consumed in making the change was 15 minutes. The cars set out were the first and fifth car of the original train, one steel car being picked up to complete the tonnage. The first car was of 60,000 lb. capacity and was an old car; also the brake on this car was cut out. The fifth car was also 60,000 lb. capacity. The shifting was done as the train passed over the hump.

Another example was a double-header, consisting of 31 cars, 30 all steel equipment, with one older and lighter capacity car on the rear end. The changes on this double-header were made by setting the first 10 cars on the cabin car, and then pulling out the other 21 cars, shoving the cabin and 10 cars on the train. The actual time consumed in making the change was 20 minutes. By making this change, it brought the older and weaker car on the rear, where it actually belonged.

A bad example was that of a train made up as follows: 1 stock car, older and lighter equipment, 1 load, 1 empty refrigerator, 4

loads, 5 empties, 3 of the older and lighter equipment, 5 loads, 5 empties, 11 loads, 7 empties, 2 loads, 9 empties, and 1 load. There was a pick-up of 16 cars on the head end of this train. With just a little bit of forethought on giving the order for the pick-up, there only needed to be 7 cars picked up and still retain the tonnage without changing the classification of the freight and at the same time shortening the train by 9 cars, eliminating four of the older and lighter capacity cars at the headend. On the other hand, picking up the seven cars, there would have been placed together 24 of the more modern cars for the headend. The actual time consumed in the make-up of this train was 1 hour 55 minutes, including pick-up and doubling over. I do not claim that all trains can be shortened, but in a majority of the trains that are built up, it is a good policy to do so.

I believe that every fair-minded person who has any knowledge of train building will agree that the 40,000, 50,000 and the older 60,000 capacity equipment has no right to be placed on or near the headend of the long heavy through trains. I know from practical experience that the most break-in-twos occur in that particular class of equipment, as the draft gear is not heavy enough to withstand the shocks and surges that are sometimes evident.

No car which is known to have its brake cut out should be placed in any train. The car should be sent to the repair track and have the proper repairs made, even though delayed for another schedule. There are cases enough where they are cut out while a train is in transit from one terminal to another.

Discussion.—It was generally agreed that the weaker and lighter capacity cars, whether loaded or empty, should be kept away from the front end of the train, but it was also stated that it was not good practice to bunch the empties at either end. They should be distributed throughout the train. In this respect it was stated that the Santa Fe place one-third of the empty cars at the head end and two-thirds at the rear end. By doing this their relatively higher braking power per gross ton is used to the best effect considering the train as a whole.

F. B. Farmer, Westinghouse Air Brake Company, made some very interesting remarks on this subject from which the following is taken:

"The spirit indicated by Mr. Noland is the one, in my judgment, which will go far toward helping to the desired end; that is doing what is possible to reduce unfavorable conditions. In one of our proceedings, in a paper on this subject, the tabulation of a very large number of break-in-twos showed conclusively that the head end of the train is where the greatest strain is experienced both in starting and in stopping, 40 per cent. of the break-in-twos occurring within ten cars of the engine. Now it is obvious that anything that can be done to get the weaker cars away from the head is going to promote the desired end.

"I have thought from the remarks of some that they would prefer the loads at the rear. Above all, for loads that is the one thing to be avoided. Put the loads at the rear and you put an anchor there to help break in two in starting. As illustrating the serious consequences that can arise from more efficient holding power at the head end, I want to relate a little incident that occurred not long ago. A train of 79 loads, with the heavier loads at the rear, was running at night in a dense fog about 30 miles an hour, approaching the end of the double track where the rules necessarily required the engineer to have his train under perfect control. The grade was gently descending. He had shut off, applied the brakes and slowed down more than he thought, released, and held the engine brake applied. He stated that he felt a jerk, and following that after running a few car lengths, a prod. That is all he knew about it until the train was examined. The damage to the train was $1,500, delay to important passenger trains 2½ to 4½ hours; 15 cars from the engine was the first damage, 16 cars ahead of the caboose the last damage. Nine drawbars were driven in and some of the running boards on the box cars smashed. When the brakes were applied the slack bunched and the heavier loads on the rear end kept it bunched. Therefore, when released, the train was in the most unfavorable condition, with the slack in heavily. In spite of holding on his engine brake, the slack ran out and caused the break-in-two, presumably, from the character of the damage, on that fifteenth car from the engine. A break-in-two under those circumstances means that the brake pipe pressure is much above the auxiliary reservoirs, particularly at the head end. Under such conditions quick action will not run; it will peter out. Therefore, when the break-in-two started instead of getting quick action at the rear, quick action was obtained on the head end only. At low speed the head end could stop quickly because the rear end was not pushing it. I would urge all in considering the make up of trains at all times to accept the empties at the rear as far superior to the empties ahead."

Mr. Noland in closing the paper stated: I do not care how you place your loads or empties in the train. In building up trains in the station order, I put the very first station on the rear end of the train if it is necessary to do so to make the train safe. Recently an engineer positively refused to pull a train out of the terminal because there were five 40,000 capacity empty cars ahead of 27 loads of coal. The yardmaster asked him why he refused to take the train out. He said, "I consider my life worth more than all those cars, and in case of undesired quick action I do not wish to have all those old empty cars climbing into the cab after me." That is exactly what they would have done. We did not delay the train more than 10 or 15 minutes in making the change.

ELECTRO-PNEUMATIC SIGNAL SYSTEM

The following is taken from a paper on this subject by L. N. Armstrong, Pennsylvania Railroad:

The present standard pneumatic train air signal used on steam trains has its limitations, and its operation on long trains is far from satisfactory for the following reasons: Where large volumes of air are used, the signal valve has to be very delicately adjusted; considerable time must elapse from the time the cord is pulled until the signal reaches the locomotive; several seconds must be allowed for the wave action of the air to subside and the line to recharge before another signal can be transmitted; false signals are given, caused by leaks in the signal line. All of these troubles have been overcome by using electricity as an agent to transmit the signal from the cars to the locomotive. The power may be furnished by batteries or by the electric generators or storage batteries that are used for lighting or other purposes.

The electro-pneumatic signal was developed a few years ago to meet the needs of roads that were using multiple unit electric cars to handle suburban service. The signal switch to which the ordinary bell cord is attached has two wire connections, one for supplying the current to the switch, and the other for conveying the current from the switch to the magnetic valve in the cab. When the cord is pulled, contact is made between the two wires, resulting in current flowing to the magnet valve, causing the signal whistle to immediately sound. When the cord is released, the spring on the side of the signal switch forecs the contacts of the switch apart, breaking the circuit and thus stopping the flow of current, causing the air valve in the magnet valve to be seated. The magnet valve consists of an electro-magnet, which, when energized, unseats a small air valve, allowing main reservoir pressure to flow directly to the whistle. The whistle will continue to sound as long as current is passing through the circuit. When the flow of current is cut off from the magnet valve, a small spring assists in seating the air valve.

The whistle has an adjustable bowl, and is the same as that used with the pneumatically operated signal. When using high main reservoir pressure, it has been found advisable to insert a choke in the pipe connection leading to the whistle having a 3/64 in. opening to prevent the whistle from screeching. The whistle can be attached to the bottom outlet of the magnetic valve by a short elbow and nipple, and when directly connected in this manner quick transmission of any number of blasts is possible, as the air has a very short distance to flow.

A combined car discharge valve and train signal switch is designed to cover the transition period on steam trains. It is the ordinary car discharge valve, having a set of contacts added and arranged so that when the cord is pulled the car discharge valve is opened and, at the same time, contact is made. A test train, consisting of an engine and twelve steel cars, was operated for a period of four months on the Pennsylvania Railroad, with such satisfactory results that the electro-pneumatic signal was recommended to be applied to all new equipment. This will eventually result in removing the train signal pipe and hose from the equipment, which will no doubt cause a considerable decrease in the expense of maintenance, and at the same time result in fewer detentions from signal failures, as well as quickening the operation of suburban trains which use the train signals for starting. With this signal system, it would be possible to have a code in which long and short blasts were used, and thus increase the communication between train and locomotive without using a large number of blasts. A test was made in which the signal cord was pulled 17 times in a period of five seconds, and all of the signals were correctly transmitted. It is absolutely free from false signals, and economical to maintain. The operation of this signal on 90 cars during the past six years has shown its reliability and low cost of maintenance, requiring no periodical inspections.

Discussion.—It was explained further that by placing a whistle on each car it would be possible for the engineer to transmit signals to the train crew which on long trains is of decided advantage, as it is often difficult for the steam whistle signals to be heard from the rear of the train. The air for the car whistles could be taken direct from the train line or auxiliary reservoir and in this way eliminate the signal pipe. If there are no wire jumpers between the cars the wires for this signal could be built in the train line air hose between the inner tube and outer wrapper.

FOUNDATION BRAKE GEAR

T. L. Burton, of the Westinghouse Air Brake Company, gave an informal talk on the clasp type of foundation brake gear at the Wednesday morning session. He spoke of the success that this type of gear had met, but also stated that the foundation gear as a whole must be correctly applied, for cases have been found where a poorly applied clasp brake gear has been less efficient than the single shoe gear. The design of the foundation brake gear should be carefully made for each individual type and design of car. It has been found impossible to have a standard arrangement for cars or trucks of different designs. C. W. Martin, of the Pennsylvania Railroad, stated that stops have been materially decreased by eliminating the interference of rods in the brake rigging. It is desired to have a design where the braking power will remain the same with worn shoes and the piston travel should always be the same. It has been found to be good practice to case-harden the pin bearings in the foundation gear. Cases were also reported where by increasing the stiffness of the gear regular stops had been decreased by from 200 to 300 ft.

AIR BRAKE HOSE

T. W. Dow, of the Erie Railroad, introduced the subject of air brake hose by a short paper, in which he stated that he believed the new M. C. B. specifications would do a great deal to eliminate the trouble that has been experienced with air brake hose. He also laid special stress on the matter of gaskets, stating that he believed too many incorrectly proportioned gaskets were being used. He believed that the previous specifications of the M. C. B. Association had not been lived up to as they should have been by the manufacturers, and that the railroads were often inclined to accept hose that did not conform to the original specifications.

G. H. Wood, of the Santa Fe, stated that he is having the same experience with the present M. C. B. hose blowing off the connections and bursting as he did with the old hose. He favored the plan of removing the hose as soon as it has been in service its guaranteed life, stating that by doing this a great many break-in-twos would be eliminated.

On the Duluth, Missabe & Northern, Mr. Remfry stated that all hose are removed after two years of service, and that the cut and burst hose trouble had been reduced 60 per cent. by this practice.

In regard to the mounting of hose, there was some difference of opinion. Some believed that all hose should be mounted by hand, while others contended that machine mounting where one end was mounted at a time was entirely successful. C. W. Martin, of the Pennsylvania, stated that he had found no difference with hand mounting and machine mounting when the latter was done as above stated, comparative tests having been made in this regard.

It was believed that the present M. C. B. hose gave more trouble from pulling off than blowing off. In the matter of gaskets a gage was recommended for testing the size, as the calipers were not accurate enough to determine the correct size. Special mention was made of the arrangement of the clamps. They should be so arranged as not to rub against the signal hose.

AIR BRAKE EFFICIENCY

Fred von Bergen, of the Nashville, Chattanooga & St. Louis, introduced the subject by a short paper, in which he claimed that it was impossible to maintain brakes at 100 per cent. efficiency. However, other members brought out the point that by setting a standard of the number of brakes which should be operated in a train and a certain definite degree of effectiveness for each brake as 100 per cent. efficiency, this could be maintained. Mr. Wood, of the Santa Fe, explained the system on that road, stating that before a train leaves the terminal all brakes must be in operating condition, and to this end they have had as many as 100 cars set out at Kansas City in 24 hours, on account of their brakes not being operative. He mentioned that in order to do this the air brake men must have the co-operation of the transportation department, and that if orders are issued, little trouble is experienced in this respect. Before a train leaves a terminal on the Santa Fe it is stretched and the brakes are set so that inspectors may readily determine weak draft gear and inefficient brakes. He stated that at one of the large terminals 16 men split into crews of two men each will handle from 65 to 75 cars per day.

Mr. Sitterly stated that he believed the M. C. B. rules should be changed to make the car owners responsible for more of the brake troubles so that more care will be taken in maintaining the air brakes in good condition. Another member stated that he believed the irregular piston travel gave the greatest trouble, and that prompt attention on the part of inspectors would give the desired results. Mr. Turner concurred in these remarks, stating that a uniform piston travel should be had throughout the whole train, and in addition the foundation gear should be kept in good condition.

The trouble of imperfectly cleaned brakes was also mentioned. This has been evidenced by the defective condition immediately after cleaning. It was stated that on examination out of 500 brakes that had been cleaned 20 per cent. were found defective one month after cleaning, which clearly showed that the work had been poorly done.

CLOSING EXERCISES

Another paper presented during the course of the convention was that of the electro-pneumatic brake by Walter V. Turner, chief engineer, Westinghouse Air Brake Company, in which he showed in a very clear manner the growth of this type of brake, tracing its development step by step from the original plain triple valve. The association adopted appropriate resolutions on the death of George Westinghouse, which clearly showed the appreciation of his work by the members of this association. The following officers were elected for the ensuing year: president, L. H. Albers, New York Central Lines; first vice-

president, J. T. Slattery, Denver & Rio Grande; second vice-president, T. W. Dow, Erie Railroad; third vice-president, C. H. Weaver, Lake Shore & Michigan Southern; secretary, F. M. Nellis, Westinghouse Air Brake Company; treasurer, Otto Best, Nathan Manufacturing Company. The new members elected to the executive committee were: L. P. Streeter, Illinois Central, and Mark Purcell, Northern Pacific. The convention was well attended throughout its four sessions, approximately 300 registering.

DURABILITY OF BRAKE SHOES ON CHILLED IRON CAR WHEELS

By F. K. Vial

Chief Engineer, Griffin Wheel Company, Chicago, Ill.

Extensive tests have been made to determine the durability of brake shoes under various operating conditions, and although much information is available showing conditions which result in a maximum brake shoe efficiency, the independent effect of each variable, such as pressure, velocity, etc., is not definitely established. However, on account of the large volume of tests with different brake shoes, it is possible to determine with a fair degree of accuracy the relation of each variable to brake shoe economy. The results of these tests show that the type of brake shoe, amount of pressure, velocity of the wheel, and character of wheel metal, have a very marked influence on the durability of the brake shoe. They also show that the characteristics of various shoes are widely different, and therefore no general law is applicable to all cases. However, there is a general similarity, and typical shoes may be chosen to indicate the extent to which various items influence brake shoe durability.

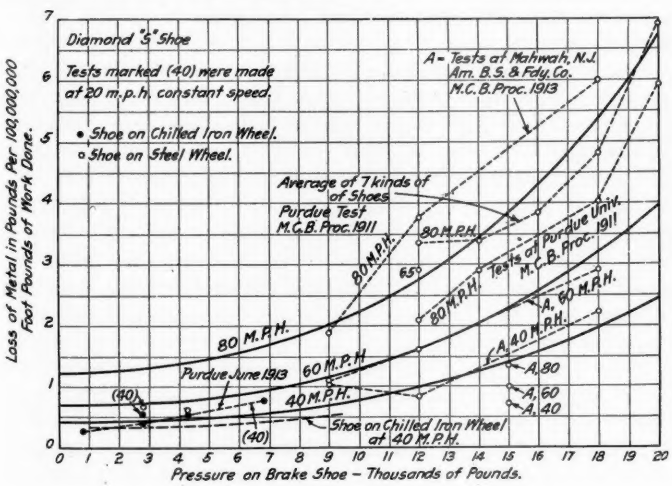


Fig. 1

The characteristics of the Diamond "S" shoe, with reference to velocity and pressure, are shown in Fig. 1. In general the results of various tests indicate a very decided decrease in brake shoe durability as the amount of work per unit of time increases, because there is less resistance to abrasion when the particles in contact are heated to high temperatures. The factors which enter into the rate at which a unit of work is performed are velocity and pressure. Under ordinary operating conditions, these two items increase and decrease in unison. The pressures used in controlling the velocity of trains on descending grades are small, but are applied continuously for a long interval of time, whereas in making stops from high velocities the shoe pressure is heavy, and is applied for a very short interval. The effect of increasing velocities and pressures on the rapidity of metal loss from the brake shoe for doing the same amount of work is clearly shown in Fig. 1.

At 6,000 lb. pressure, the loss in brake shoe metal for each 100,000,000 foot pounds of energy destroyed in making stops from 40 m. p. h. was ½ lb., and from 80 m. p. h., 1.6 lb., or more than three times as much. With a pressure of 18,000 lb. this difference is substantially the same. Regarding the effect of increasing the pressure at the same speed it is found that at 40 m. p. h. the loss of brake shoe metal under 6,000 lb. shoe pressure is ½ lb. for doing the same amount of work that requires a loss of 2 lb. under 18,000 lb. pressure at the same velocity. The ratio in this case is four to one. The factor of increased loss of metal from the brake shoe when velocity and pressure are increased simultaneously, is the product of the factor of increased loss on account of velocity, multiplied by the factor for increased pressure, hence the loss under 18,000 lb. pressure from an initial velocity of 80 m. p. h. is 12 times as great as under 6,000 lb. pressure at 40 m. p. h. Reference to Fig. 1 indicates this to be true.

The laws of increased brake shoe consumption under heavy pressures indicate a marked economy when two shoes are used on the same wheel, as in the clasp type of brake rigging. The reason for this is the very material increase in coefficient of friction combined with the smaller metal loss at reduced pressures. In making stops from 60 m. p. h. for a shoe pressure of 16,000 lb. on a single shoe, the loss of metal is 2½ lb. per 100,000,000 foot pounds of energy destroyed. The same work will be accomplished with two shoes under 5,000 lb. brake pressure, because the coefficient of friction is increased from 10 per cent. to 16 per cent., and the metal loss under this condition is slightly under ½ lb. per shoe, or 1 lb. per two shoes, thus showing an increased durability of 150 per cent. This item is only incidental in this type of brake rigging as other favorable conditions are responsible for the idea.

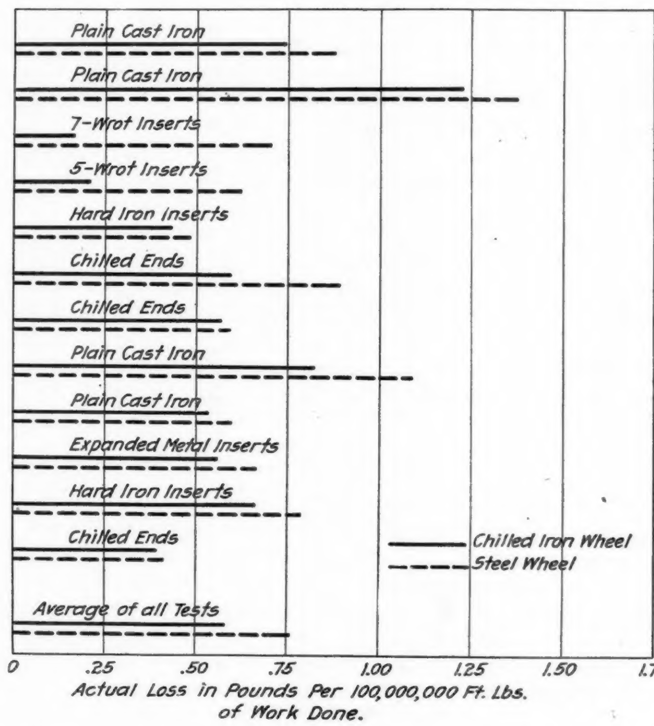


Fig. 2—Loss in Brake Shoe Metal; Pressure, 2808 lb.; Constant Speed, 20 Miles per Hour

A very important item in wheel economy is the relation of the type of metal of which the wheel is composed to brake shoe durability. Fig. 2 is a graphical illustration of the relative metal loss from brake shoes on chilled iron and steel wheels when doing the same amount of work under the same conditions. Twelve different varieties of shoes are shown under a pressure of 2,808 lb. at a constant speed of 20 m. p. h. The results are the average from 100 to 300 applications of each shoe for approximately 200 revolutions at each application. The important point to be noted is the greater metal loss in every case when the shoe is applied to the steel wheel than when applied to the

chilled iron wheel. In a great many cases the shoe having the greatest wearing value contains inserts, which cannot be used on the steel wheel on account of the scoring action. It is customary to use brake shoes on steel wheels having higher metal losses in order to protect the metal of the tread.

A good example of this is the test made with two Congdon shoes on steel and chilled iron wheels at Purdue University, and reported in the M. C. B. Proceedings of 1910. The metal loss with the chilled iron wheel was less than one-third the loss of the average of all shoes tested on the chilled iron wheel, and less than one-half the loss from the most durable shoe tested on the steel wheel. Inasmuch as the use of the Congdon shoe is entirely consistent when applied to chilled iron wheels, it is entirely fair to assume 100 per cent. increase in durability over any shoe which may be applied to the steel wheel. This result is also confirmed by investigations and practice by various railroads. Service tests under similar conditions indicate that the chilled iron wheel has the advantage of from 25 per cent. to 50 per cent. in brake shoe consumption. This property of chilled iron results in a very material brake shoe economy when we consider that the value of brake shoes manufactured annually is upwards of eight million dollars, and that the use of the chilled iron wheel represents a saving of two million to four million dollars annually in brake shoe consumption, which must be considered when comparing the relative economies of different types of wheels.

If the structure of chilled iron and steel be examined, much light will be thrown on the cause for the differences in coefficient of friction and metal loss from brake shoes. The grain of chilled iron is at right angles to the tread, hence the wearing is similar to that of the end grain of wood, which is greater than in the direction of the grain. The action between the shoe and surface of the wheel is purely frictional, whereas the tread of the steel wheel is more or less fibrous in the direction of the circumference, so that the surface is roughened by the sharp particles which produce a cutting action, reducing the coefficient of friction and increasing the metal loss from both wheel and shoe.

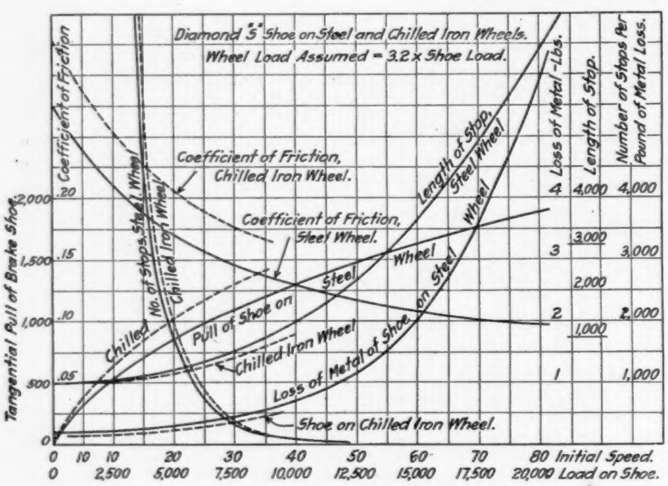


Fig. 3

A summary of the relation of chilled iron and steel wheels to brake service is shown in Fig. 3, various features of which have been previously discussed, and the items under like pressures, which favor the chilled iron wheel, may be summarized as follows: 20 per cent. greater coefficient of friction; 20 per cent. greater tangential pull; 20 per cent. shorter stops; 25 per cent. to 50 per cent. less metal loss from brake shoes for doing the same work; a greater number of stops per life of brake shoe and combined efficiency of coefficient of friction, and low loss of metal results in a large saving annually in brake shoe consumption.

RECOMMENDED CHANGES IN BOILER INSPECTION RULES

Rule No. 2 of the United States government locomotive boiler inspection rules provides as follows:

> The lowest factor of safety to be used for all locomotives in service or under construction on or before January 1, 1912, will be fixed after investigation and hearing and after the expiration of the time allowed for filing specification cards.

In accordance therewith, a meeting was held at the office of the chief inspector of locomotive boilers at Washington, D. C., April 28 and 29, 1914, at which the government, the railways and the railway employees were represented.

The following changes in rules 2, 3, 24, 52 and 54 were agreed upon to be submitted to the Interstate Commerce Commission for approval. A hearing has been set for 10:30 a. m., June 3, 1914, in the offices of the commission at Washington:

Rule 2.—The lowest factor of safety to be used for locomotive boilers constructed after January 1, 1912, shall be 4.

The lowest factor of safety to be used for locomotive boilers which were in service or under construction prior to January 1, 1912, shall be as follows: Effective January 1, 1915, the lowest factor shall be 3, except that upon application, this period may be extended not to exceed one year, if an investigation shows that conditions warrant it; effective January 1, 1916, the lowest factor shall be 3.25; effective January 1, 1917, the lowest factor shall be 3.5; effective January 1, 1919, the lowest factor shall be 3.75; effective January 1, 1921, the lowest factor shall be 4.

Rule 3.—For locomotives constructed after January 1, 1915, the maximum allowable stress per square inch of net cross sectional area on firebox and combustion chamber stays shall be 7,500 lb. The maximum allowable stress per square inch of net cross sectional area on round, rectangular or gusset braces shall be 9,000 lb.

For locomotives constructed prior to January 1, 1915, the maximum allowable stress on stays and braces shall meet the requirements of rule No. 2, except that when a new firebox and wrapper sheet are applied to such locomotives they shall be made to meet the requirements of rule No. 3.

Rule 24.—Flexible staybolts which do not have caps shall be tested once each month the same as rigid bolts. Each time a hydrostatic test is applied such staybolt test shall be made while the boiler is under hydrostatic pressure not less than the allowed working pressure, and proper notation of such test made on form No. 3.

Rule 52.—A copy of the monthly inspection report, form No. 1, or annual inspection report, form No. 3, properly filled out, shall be placed under glass in a conspicuous place in the cab of the locomotive before the boiler inspected is put into service.

Add to Rule 54.—When any repairs or changes are made which affect the data shown on the specification card, a corrected card or an alteration report on an approved form, size 8 in. by 10½ in., properly certified to, giving details of such changes, shall be filed within thirty days from the date of their completion.

This report should cover: *A,* application of new barrel sheets or domes; *B,* application of patches to barrels or domes of boilers or to portion of wrapper sheet of crownbar boilers which is not supported by staybolts; *C,* longitudinal seam reinforcements; *D,* changes in size or number of braces, giving maximum stress; *E,* initial application of superheaters, arch or water bar tubes, giving number and dimensions of tubes; *F,* changes in number or capacity of safety valves.

Report of patches should be accompanied by a drawing or blue print of the patch showing its location in regard to the center line of the boiler, giving all necessary dimensions and showing the nature and location of the defect. Patches previously applied should be reported the first time the boiler is stripped to permit an examination.

Fourth Section Violations in the Southeast

Relief Given If Water or Rail Competition Causes Disadvantage, But Not for Market Competition Only

The following is an abstract of the findings of the Interstate Commerce Commission in the matter of applications for relief from the provisions of the Fourth Section of the Act to Regulate Commerce with respect to class and commodity rates from eastern cities, Ohio river crossings and New Orleans, La., to south Atlantic and gulf ports, certain points on navigable streams, and certain interior basing points in southeastern and Mississippi valley territory: with respect also to class and commodity rates from St. Louis, Mo., and Chicago to gulf ports, Mississippi river points, and to Meridian and Jackson, Miss.:

The position and conformation of the territory involved have brought about competitive conditions to some extent unlike those existing in any other large section. It is bound on all four sides by navigable water and on the north by strong lines of railroads of high traffic density maintaining rates materially lower than the southern lines can usually afford to accept. The territory is also pierced by numerous streams which afford means of transportation between various points that have had the effect of depressing the rates between such points to a level below what they might have been were it not for the influence of these streams. The southern railways, in seeking to meet the competition of the water carriers, have thought it necessary, in many instances, to depart from the rule of the fourth section and concerning such departures have sought at the hands of the commission relief from the strict application of that section. In other instances, at points where water competition does not exist, relief is sought upon the grounds that the influence of rival markets and contending railroad and commercial interests have so reduced the rates as to make them less than merely reasonable and remunerative. In many instances, the commission has found the rates to the more distant points justified by competition and the rates to intermediate points appearing reasonable in comparison with other rates made for like distances in the same territory under nearly similar conditions. In the absence of complaints with reference to the rates to such intermediate points, it will permit for the present the continuance of the lower rates to the more distant points and the present higher rates to the intermediate points. In other situations, it has found the rates to more distant points justified by competition and the rates to intermediate points not bearing reasonable comparison with other rates for like distances in the same general territory. In such cases, the continuance of the lower rates to more distant points and higher rates to intermediate points will be permitted, provided the rates to the latter do not exceed the scale of rates hereinafter named.

New York has been selected as a representative eastern city. Cincinnati and Louisville have been selected as representative Ohio river crossings. Augusta, Ga., on the Savannah river; Macon and Hawkinsville, Ga., on the Ocmulgee river; Milledgeville and Dublin, Ga., on the Oconee river; Columbus, Ga., Eufaula, Ala., River Junction, Fla., on the Chattahoochee river; Albany, Ga., on the Flint river; Montgomery and Selma, Ala., on the Alabama river; Tuscaloosa, Ala., on the Warrior river; Demopolis, Ala., on the Tombigbee river; Chattanooga, Tenn., on the Tennessee river and Memphis, Tenn., on the Mississippi river have been selected as representative points on navigable rivers. Atlanta, Athens, Cordele and Roce, Ga., Birmingham, Ala., Meridian and Jackson, Miss., have been selected as representative interior basing points. Greenville, Vicksburg and Natchez, Miss., have been selected as representative Mississippi river points; New Orleans, La., Mobile, Ala., Pensacola and Tampa, Fla., have been selected as representative gulf ports. The discussion of the case has been divided into twelve subdivisions, as will be seen from the several headed sections below.

An investigation was carried on for the purpose of ascertaining the effect of an absolutely rigid enforcement of the long and short haul clause, accomplished by a reduction in rates to intermediate points and without any increase in rates to long distance points now taking lower rates. Thirty-three railway systems operating upward of 29,000 miles, and three steamship companies joined in a check. The mileage of all roads south of the Ohio river and east of the Mississippi river is in round numbers 40,000 miles. The net surplus for the fiscal year 1911 per mile of road was $917. Were the long and short haul rule rigidly applied and no increases made in rates to lower rated points, the surplus would be reduced to $516. It is therefore entirely clear that the revenues of a large percentage of the lines in southeastern territory would be so impaired as to make it impossible for them to meet their operating expenses, taxes and fixed charges and leave to their stockholders even a moderate return.

RATES FROM NEW YORK TO SOUTH ATLANTIC PORTS

The all-rail routes selected from New York to the southern Atlantic ports of Charleston, Savannah, Brunswick and Jacksonville, are in all instances via the Pennsylvania Railroad to Potomac yards. The water-and-rail routes selected are via the Old Dominion Steamship Company to Norfolk. The Clyde Line, the Ocean Steamship Company, the Merchants & Miners Transportation Company, do an important regular business to these south Atlantic ports and in addition large quantities of low-grade commodities move by tramp and other irregular steamers, the latter acting as a check on the regular lines. During 1910, 98 per cent. of all the freight which moved from New York to Charleston went by water. During the last half of 1911, of all the tonnage coming into Charleston from every direction, excluding the tonnage of irregular ships, and also the commodities not handled at all by water, 25.7 per cent. moved via the steamer lines. Similar conditions obtain at Savannah and the other south Atlantic ports. Rates are published via rail and ocean through New York to all south Atlantic ports from nearly every important point in central freight association territory which are materially lower than the all rail rates applicable upon like traffic. It is clear that the rates from New York to the south Atlantic ports are strongly influenced by water competition and that any substantial increase in the all rail rates or the water and rail rates would result in loss of tonnage.

Exhibit 117, filed with reference to the applications, showed 800 different rates in southeastern territory made from some of the principal cities which distribute therein, including Cincinnati, Louisville, New Orleans, Memphis, Chattanooga, Savannah and Birmingham. These rates are in nearly every instance rates made to non-competitive points, although in some instances they may have been influenced by their contiguity to competitive points. For the purpose of instituting comparisons with rates that are the subject of consideration in this report, a table has been compiled showing the average rates for distances from 300 to 750 miles. The table is as follows:

Distance.	1	2	3	4	5	6	A	B	C	D	E	H	F
300 miles:													
One line	96	84	69	63	51	45	38	38	31	25	46	55	52
Two or more lines..	106	92	79	66	56	47	40	44	30	26	52	56	55
350 miles:													
One line	103	89	73	69	55	47	40	41	33	26	50	58	55
Two or more lines..	110	95	84	69	58	48	39	44	32	27	52	59	57
400 miles:													
One line	110	95	77	69	58	49	41	43	34	27	51	59	57
Two or more lines..	112	98	87	72	60	49	39	44	32	27	54	60	57
450 miles:													
One line	115	98	80	69	59	51	41	44	34	28	52	60	60
Two or more lines..	114	100	89	74	62	50	39	44	33	27	55	62	56

Distance.	1	2	3	4	5	6	A	B	C	D	E	H	F
500 miles:													
One line	116	99	83	70	60	51	41	45	34	29	53	62	62
Two or more lines	120	104	92	76	64	52	40	46	34	29	56	64	60
550 miles:													
One line	117	100	85	72	61	52	43	46	35	30	54	65	64
Two or more lines	128	112	99	83	69	56	43	48	37	31	61	69	64
600 miles:													
One line	118	102	86	74	63	53	44	47	36	30	56	64	64
Two or more lines	131	114	101	85	70	58	44	49	38	32	62	71	66
650 miles:													
One line	123	106	89	78	66	56	45	49	37	32	59	67	66
Two or more lines	137	118	106	90	74	60	47	51	40	33	66	74	68
700 miles:													
One line	128	110	94	82	70	59	47	51	38	33	63	69	70
Two or more lines	142	126	113	94	80	66	50	53	43	35	65	77	71
750 miles:													
One line	133	114	98	86	73	62	49	54	39	34	70	73	73
Two or more lines	147	130	118	98	84	69	53	56	45	36	74	80	73

The conclusion is warranted that the rates made from New York to the south Atlantic ports are subnormal. Their acceptance by the carriers results in some net revenue and does not result in an increased burden on traffic to and from intermediate points, however.

A comparison of the rates to the higher rated intermediate points with those shown in Exhibit 117 shows that the former are not unreasonable or out of line with rates made to contiguous points in the same territory. The carriers will therefore be permitted to charge rates to intermediate points from New York and eastern points in excess of the rates to south Atlantic ports.

RATES FROM NEW YORK TO NEW ORLEANS, MOBILE AND PENSACOLA

The all rail route selected is via Potomac yard. The rail and water route is through Norfolk. There is also a water and rail route through Savannah via the Ocean Steamship Company to that port. There is strong competition on the part of the Mallory Steamship Company from New York to New Orleans and Mobile and the Morgan line, and the Philadelphia & Gulf Steamship Company to New Orleans. There is no regular water service between New York and Pensacola, and it is evident that but little traffic is carried by other boats. It is held that the all rail and water and rail rates made to Mobile and to New Orleans are necessitated by water competition existing between eastern ports and these points respectively, but that sufficient justification has not been shown for the maintenance of the present scale of water and rail rates to Pensacola via Mobile or via the south Atlantic ports. On account of the contiguity of Mobile to Pensacola and the actual and potential water competition existing between these points, however, it would probably be impracticable to maintain at Pensacola rates which are substantially higher than the rates to Mobile and to New Orleans. As none of the higher rates to intermediate points are found unreasonable, therefore, the carriers may continue them and such rates from New York to New Orleans, Mobile and Pensacola as will enable them to effectively meet the competition of water carriers.

RATES FROM NEW ORLEANS TO SOUTH ATLANTIC PORTS AND TAMPA

A regular all water service is furnished by the Philadelphia & Gulf Steamship Company between New Orleans and Charleston, and by the Paine Steamship Company between New Orleans and Tampa. There is no regular all water service to Savannah, Brunswick or Jacksonville. There is, however, a large movement of traffic in irregular coastwise vessels. The long distance rates, therefore, may be held to be depressed because of water competition. They are in fact subnormal, but they yield sufficient revenue to cover the additional cost of handling. The carriers, therefore, may continue lower rates to Charleston and their present higher rates to intermediate points. They may also continue lower rates to Savannah and higher rates to intermediate points, provided the rates to points west of Helena, Ga., do not exceed the present rates to Helena and the rates to points east do not exceed the rates to that point by more than 5 per cent. The lower rates to Brunswick over the Louisville & Nashville and the Atlantic Coast Line are held justifiable, but on this route the rates to Thomasville, Quitman and Valdosta, appear to be markedly out of line with the rates to contiguous stations. There is no adequate justification for departing from a uniform gradation of rates on this line that increase with distance up to some maximum rate point east of which the rates will be decreased through combination on Brunswick. The rates to Naylor should not be exceeded at Valdosta and at stations between Naylor and Brunswick. It is held in like fashion as to the route to Jacksonville that the rates should also grade with distance; the maximum rate point or points should be reached at some station between Madison and Lake City, and east thereof the rates should diminish with distance as Jacksonville is approached.

RATES FROM OHIO RIVER CROSSINGS TO SOUTH ATLANTIC PORTS

Cincinnati and Louisville have been selected as representative Ohio river crossings and the report discusses rates via selected routes from them to each of the south Atlantic ports. The commission believes that the rates made from the crossings to the southern ports are induced by an active and compelling competition on the part of the trunk lines from the Ohio river cities and central freight association territory to north Atlantic ports, together with the steamships operating from the latter to southern ports, and that these rates cannot be materially increased without loss of traffic. The rates, although they are subnormal, yield sufficient revenue to cover the additional cost of handling. Some of the rates to intermediate stations on the routes selected are found unreasonable. It is held that the rates to Morristown, Tenn., on the route from Cincinnati to Charleston, now blanketed from Morristown to Asheville, should also be granted to the intermediate stations, Mascot to Alpha. On the route from Louisville to Savannah via the Louisville & Nashville to Montgomery and the Seaboard Air Line, the rates from Louisville to Helena, Ga., should not be exceeded at intermediate points and the rates to points east of Helena should not exceed the Helena rates by more than 5 per cent. The Louisville & Nashville, and the Atlantic Coast Line will be authorized to continue lower rates from Louisville to Brunswick than to intermediate points, provided all intermediate and junction points except Bainbridge between Montgomery and Dupont are made to conform to the long and short haul rule. It is also held that the rates to points intermediate to Helena on the route from Cincinnati to Brunswick should not be exceeded at intermediate points. Relief is granted as to the rates made from Louisville to Jacksonville, provided the departures from the fourth section in the rates to intermediate local and intermediate junction points, such as Tallahassee, Greenville, Madison and Live Oak, are corrected by establishing graded or blanket rates thereto not higher than the average rates in Exhibit 117.

RATES FROM OHIO RIVER CROSSINGS, ST. LOUIS AND CHICAGO TO GULF PORTS

The carriers contend that the lower rates between these points have been brought about by an active competition of water carriers on the Ohio and Mississippi serving New Orleans by direct movement from Cincinnati and Louisville; by the competition of water carriers on the Gulf of Mexico and by the rivalry of trade between the gulf ports as distributing centers and as ports for foreign business. The testimony includes a very detailed history of water transportation on the Mississippi and Ohio rivers. It is very clear that the river traffic was at one time exceedingly important.

It is also evident that this river traffic did not materially decrease until 1898, eleven years after the establishment of the present scale of rail rates, on August 1, 1887. In 1912 there were no regular boat lines in operation from Ohio river points or St. Louis to New Orleans, and regular service of this character had not been furnished for some years. During the season of high water in the Ohio river, however, a considerable fleet of boats comes down from Pittsburgh to New Orleans,

carrying principally coal, iron and steel. It may be possible that the petitioners could increase the rates from the Ohio river cities and Chicago to New Orleans in some degree and still continue to hold the traffic on the rail lines. The fact, however, that the boats maintained themselves for more than 12 years in competition with the scale of rates now existing indicates that the petitioners have gone little if any further than the circumstances required in an effort to meet the water competition, actual or potential, with which they have been confronted.

The same causes that have brought about reduced rates to New Orleans have at the same time greatly influenced the rates to Mobile. The maintenance of water service via the Mississippi river, the Mississippi sound, and the Gulf of Mexico had the effect of bringing about a relation of rates and much of the time a parity between the rates to Mobile and New Orleans. The carriers can successfully maintain rates to Mobile that are but little higher than those to New Orleans, and the commission believes that the long standing parity of rates should not be disturbed. Conditions at Pensacola appear to be in nearly all respects thoroughly comparable to those obtaining at Mobile. The competition with rail and ocean carriers operates to reduce the all rail rates to Tampa. The rates to these various golf ports are considered subnormal, but sufficiently remunerative to cover the additional cost of handling. The carriers are, therefore, permitted relief from the fourth section. It is found, however, that the rates to Yellow Pine, Ala., on the route from St. Louis to Mobile are unreasonable to the extent that they exceed the average rates shown in Exhibit 117.

RATES FROM OHIO RIVER CROSSINGS. ST. LOUIS AND CHICAGO TO MEMPHIS, GREENVILLE, VICKSBURG AND NATCHEZ

Cairo, Louisville and Cincinnati have been selected as representative Ohio river crossings. The commission is of the opinion that the rates from them, St. Louis and Chicago to the Mississippi river crossings named have been and are now necessitated by the competition of boats on the Mississippi. The rates are subnormal, but there is no doubt that they pay more than the additional cost of handling. The carriers are therefore allowed to continue lower rates to these river points and higher rates to intermediate points, provided the rates to the latter on the routes from Louisville, St. Louis, Cairo and Chicago that now exceed the rates made over one-line hauls for like distances, as shown from Exhibit 117, be corrected in such manner as not to exceed such average rates. The last applies particularly to the rates to certain stations on the Yazoo and Mississippi Valley.

RATES FROM NEW YORK CITY TO POINTS ON NAVIGABLE RIVERS

New York has been selected as representative of the eastern cities. The selected points on navigable streams are named in the first part of the report. Augusta, Ga., is served by several railroads and steamship lines and is in competition for trade with Charleston, Savannah, Columbia, Macon and Atlanta. This competition between the cities has been somewhat influential in bringing about the present low level of rates, but the low rates are the result, in the main, of water competition and could not be materially advanced without consequent loss of traffic to the rail carriers. The rates to Green Cut, Ga., on the route to Augusta are, however, found unreasonable. The water competition to Memphis, although potential only, is held to constitute sufficient justification for low through rates to that point. The rates maintained from eastern cities to Macon from 1884 to 1905 were necessitated by actual water competition. The present level of rates is due rather to reductions made to Atlanta and other points with which Macon competes as a distributing center. The maintenance of these rates to Macon and higher rates to intermediate points west of Millen, Ga., is therefore held to constitute undue preference in favor of Macon as against intermediate points. Similar considerations also apply at Milledgeville, Hawkinsville and Dublin, which enjoy the same rates from New York as Macon. It is also held that the rates to the stations from Toomsboro to Gordon, Ga., are unreasonable.

The commission finds in like manner that the present rates to Columbus and Eufaula are not necessitated by actual competition. Permission to maintain lower rates to Albany, Ga., than to intermediate points is denied. The present level of rates from New York to Montgomery, Selma, Demopolis and Tuscaloosa is held to be necessitated by conditions over which the carriers have no control, so lower rates to them than to intermediate points are allowed. The present rates to Hurtsboro, Ala., on the route to Montgomery must not be exceeded at stations east thereof, however, and the rates to stations west must not be more than 5 per cent. in excess. The rates to stations between Selma and Demopolis should not exceed the rates to the former by more than 20, 18, 15, 13, 11 and 10 cents on the first six classes respectively.

RATES FROM NEW ORLEANS TO POINTS ON NAVIGABLE RIVERS

The carriers will be permitted to maintain lower rates from New Orleans to Augusta than to intermediate points. The low rates have been chiefly brought about by the desire of the carriers to transport articles from western points to Augusta which come into competition at that point with the same or similar articles transported from eastern cities at low rates resulting from the water competition from the latter. It is held that this policy of meeting the competition of carriers serving other markets of production has been observed consistently by the carriers serving Augusta without thereby unduly discriminating against higher rated intermediate points. The low rates to Macon, Columbus and Albany are held to be the result of competition between markets with the result that the applications for relief as to these points are denied. Relief as to the rates to Albany, Ga., is likewise refused. The rates to Montgomery and Selma were reduced some years ago in accordance with the finding in a previous case; there is no justification for higher rates to intermediate points.

RATES FROM CINCINNATI AND LOUISVILLE TO POINTS ON NAVIGABLE RIVERS

The low level of rates from Cincinnati and Louisville to Augusta is chiefly the result of the competition of the trunk line carriers and the steamship companies from the north Atlantic ports. The movement via these routes is increasing and any material increase in the all rail rates to Augusta will have the effect of directing a larger percentage of the traffic to other routes. There is also the competition of Augusta as a distributing market and that of the carriers serving eastern markets of supply. It is held that the rates to Augusta are no lower than the actual competition has required and that higher rates to intermediate points may be continued provided the rates to Buckhead, Ga., on the route from Louisville are reduced to the average as shown in Exhibit 117. The carriers are also allowed relief as to the rates to Macon and intermediate points. They must, however, reduce the rates to Bibb, Ga., on the route from Cincinnati. On the route from Louisville, the rates to McDonough and Fort Valley are termed preferential, and it is also ruled that the rates from Louisville to intermediate stations between Columbus and Macon should not exceed the rates from New York.

The rates to Columbus have been influenced by water competition via the Ohio and Mississippi, the Gulf of Mexico and the Apalachicola and Chattahoochee, as well as by the competition of the eastern carriers and other markets of distribution. The rates to Columbus from Louisville are very slightly less than the rates from New York. The fourth section application is therefore granted, but the rates to Woodbury, Ga., on the route from Cincinnati and Dadeville on the route from Louisville are to be reduced to the average as shown in Exhibit 117. Authority to continue lower rates from Cincinnati and Louisville to Albany is denied. The primary cause for the depressed

rates to Montgomery and Selma is the water competition on the Alabama river; the application for relief is granted, but certain rates to stations on the Atlanta & West Point north of West Point, Ga., on the route from Cincinnati are held unreasonable. It is also held that the rates to Maplesville, Ala., a station on the Southern and Mobile & Ohio, between Birmingham and Selma on the route from Cincinnati, should be observed as maxima to intermediate points. The low rates to Chattanooga are the result of a decision in a former case; lower rates to intermediate points are not permitted.

RATES FROM NEW YORK TO INTERIOR BASING POINTS

The commission will allow the carriers to continue water and rail rates from New York to Birmingham, Rome, Meridian and Jackson lower than to intermediate points, but not to Atlanta, Athens and Cordele than to intermediate points. The present rates to Atlanta were reduced to their present level on February 1, 1905, and were the result of a compromise between the carriers and the Railroad Commission of Georgia. The reductions in rates to Atlanta already relatively low resulted in proportional reductions to Columbus, Macon, Augusta, Rome, Athens, Dalton, Cedartown, Cartersville, Cordele, Americus, Albany, and many other places. The fundamental reason for granting relief to any line at a given point is the meeting at that point of the competition of other carriers, against which the petitioner is at a disadvantage. The carriers from west and east meet at Atlanta and compete under fairly equal conditions, however. The rates maintained to Atlanta from New York, Baltimore and the Ohio river cities, through nearly all the years from 1884 to 1905, were rates resulting from competition, compromise and agreements. They were observed as maxima by carriers operating through Norfolk and Potomac yards. Were they effective at this time the commission would have no hesitation, in view of the statute, in requiring their observance as maxima at intermediate points on all fairly direct lines. That being the case, to permit these carriers to continue higher rates at intermediate points is to place upon these points a burden of which they would be relieved were it not for the fact that the rates to Atlanta have become depressed to a level not necessitated by the competition at that point. The existing condition of rates to Atlanta is one for which, certainly, shippers at intermediate stations, individually and collectively, are in no way responsible.

The maintenance of low rates to Birmingham is held justifiable because of the competition of the low rates made by carriers from western centers of production. The competition of the latter carriers has been met consistently by the carriers from the east of Birmingham and at points intermediate thereto between Atlanta and Birmingham.

Relief is afforded as to the rates to Rome and intermediate stations because it is held that the carriers from the east are at some disadvantage in distance as against carriers from the west. The rates to Dallas, Ga., on the route to Rome are, however, termed unreasonable. It is held as to Meridian and Jackson that the maintenance of the present all-rail rates and water and rail rates to these points via Norfolk and via the south Atlantic ports is necessitated by the competition of the gulf lines and that of carriers serving the Ohio river cities. Lower rates are, therefore, permitted to Meridian than to intermediate points on the route via Norfolk, but it is held that the rates to Akron on the Alabama Great Southern between Birmingham and Meridian are unreasonable. Lower rates are also permitted to Jackson; but the carriers must observe the rates to Newton as maxima to all stations between Meridian and Newton. The maintenance of higher rates to Meridian and Jackson than to intermediate points on the water and rail route through New Orleans is not permitted.

RATES FROM NEW ORLEANS TO ATLANTA, BIRMINGHAM, ATHENS, ROME AND CORDELE

The carriers from New Orleans to the five points of destination named above have to meet the competition of the carriers serving the same points from New York and the Ohio river cities, and in some instances there is also to be considered the competition of the cities as distributing markets. The commission finds that the petitioners do not have to compete at any substantial disadvantage and that there is therefore no ground for relief from the requirements of the fourth section. As a result rates to intermediate points which are in excess of the rates to the five cities involved are held to be discriminatory.

RATES FROM OHIO RIVER CITIES, CHICAGO AND ST. LOUIS TO INTERIOR BASING POINTS

Authority to continue rates from Cincinnati and Louisville to Atlanta, Birmingham, Athens, Cordele and Rome, and from Cairo, St. Louis, Chicago, Louisville and Cincinnati to Meridian and Jackson that are lower than to intermediate points is denied in every case. The competition met is that on the part of the carriers from eastern cities and that of other distributing centers for trade in common territory, and in no case is this held sufficient for the granting of relief under the fourth section. Rates that are higher to intermediate points on the routes involved are, therefore, termed discriminatory.

RATES ON THE LETTERED CLASSES AND COMMODITY RATES

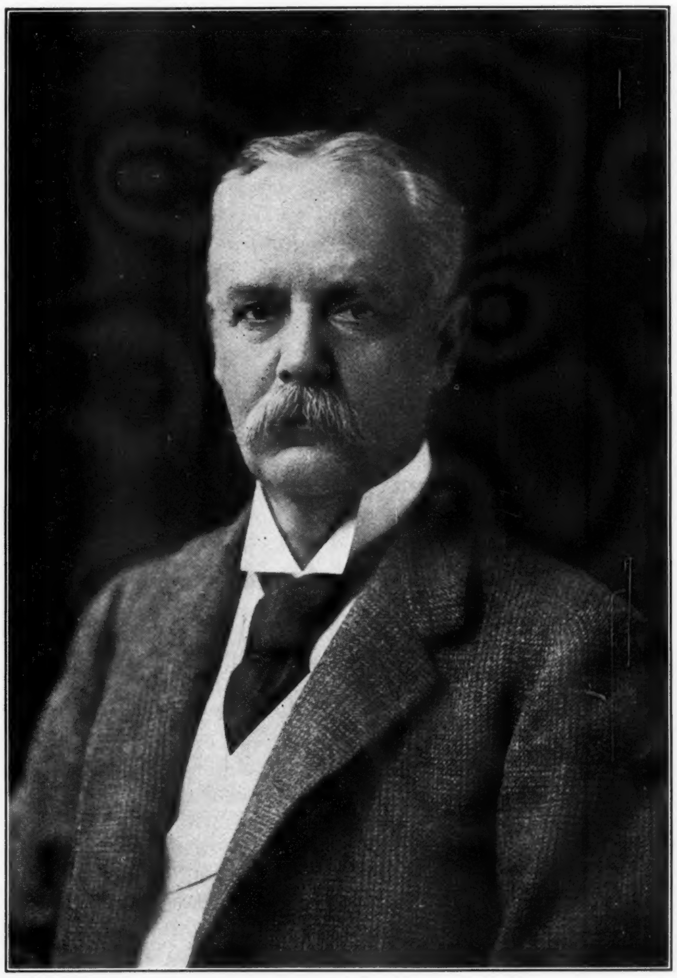
Where relief from the provisions of the fourth section is authorized with the provision that the rates to intermediate points shall not exceed certain rates herein named on the numbered classes, the rates on the lettered classes must not exceed the rates on the lettered classes shown in Exhibit 117 as corresponding to the rates named therein on the numbered classes.

The disparities shown above between the class rates to the long distance points, on the one hand, and to intermediate points, on the other, are not fairly representative of the disparities that exist as to commodity rates. The cities of Atlanta, Birmingham, Athens, Augusta, Rome, Charleston, Savannah, Brunswick, Jacksonville, New Orleans, Mobile, Montgomery, Memphis and many other important places, have a large number of special commodity rates from eastern cities, New Orleans and Ohio river crossings. Comparatively few commodity rates are made to the intermediate points. In all those instances where a carrier may be authorized to charge lower rates to more distant than to intermediate points the rates on a commodity to an intermediate point should not exceed the rate on the same commodity to the more distant point by more than the difference by which the rate on the class to which the commodity belongs exceeds the rate on the same class to the more distant point.

The routes herein described are in all instances workable routes fairly direct, but not in all cases the short lines. In all those instances where carriers are denied authority to continue lower rates to more distant than to intermediate points on the routes named, carriers operating other routes between the same points which do not exceed the length of the routes described by 15 per cent. or more, and which are meeting via such lines the rates of the lines described in the report, will be denied authority to continue lower rates to the more distant points than to points intermediate thereto. Carriers operating via circuitous routes from and to the points last described, whose lines exceed those described in the report by 15 per cent. or more, may continue to meet the competition of the direct lines at the more distant points and to maintain higher rates to the intermediate points, provided the class rates to intermediate points do not exceed the average rates in this territory for like distances and the tariffs containing commodity rates to the more distant points provide for the publication of commodity rates to intermediate stations upon demand. In all those instances where carriers are authorized to continue lower rates to more distant than to intermediate points, carriers operating other routes and publishing rates from and to the same points may continue to meet the competition of the lines described in the report at the more distant points, and may continue higher rates to intermediate points under the same restrictions above prescribed with respect to indirect routes.

THEODORE VOORHEES

The various duties and responsibilities which were centered in George F. Baer, late president of the companies embraced in the Reading system, have been divided among a number of men. E. T. Stotesbury, senior partner of Drexel & Company, Philadelphia, has been elected president of the Reading Company and chairman of the board of directors of the Philadelphia & Reading Railway, and of the Central of New Jersey. In regard to the election of Mr. Stotesbury, the directors made the following statement: "As is well known, Mr. Stotesbury has been a member of the Reading board for a number of years and has taken a great interest in the affairs of that company. His personal relations with Mr. Baer were very intimate, and probably he, better than any one else, was in a position to know the views which Mr. Baer held concerning the future of the properties which he had so long and so successfully managed." W. G. Besler has been elected president of the Central of New Jersey, as was announced in these columns last week, and Theodore Voorhees, vice-president, has been elected president of the Philadelphia & Reading.



Theodore Voorhees

Theodore Voorhees was born on June 4, 1847, in New York City. He was graduated from the Rensselaer Polytechnic Institute, Troy, N. Y., in 1869. He began railway work in July of that year on the Delaware, Lackawanna & Western in the engineering department. After about four years' work in this department he was made superintendent of the Syracuse, Binghamton & New York. In December, 1874, he went to the Delaware & Hudson Canal Company, and for ten years, from 1875 to 1885 was superintendent of the Saratoga & Champlain division of that company's road, resigned and was appointed assistant general superintendent of the New York Central & Hudson River. Five years later he was promoted to general superintendent, acting also as general superintendent of the Rome, Watertown & Ogdensburg. In 1893 he resigned and went to the Philadelphia & Reading as vice-president. Mr. Voorhees has been really a vice-president, not merely head of a department with that title. That is to say, he has been the active coadjutor of President Baer in the general executive field; and thus his duties are now enlarged, but not radically changed.

As an operating officer, however, he had had a career of marked success for 15 or 20 years before he went to the Reading, and it is for his work in the operating field that he is best known. He was one of the notable progressives in those years when the use of block signaling was being extended in the United States, and was a leader in the introduction of all safety devices. He was general superintendent of the New York Central when that road introduced the controlled manual block system from New York to Buffalo, a radical improvement which constituted a landmark in American railroad history. He also introduced the first "normal-danger" automatic block signals. About the same time (1891) the New York Central put on the Empire State Express, with the phenomenal run of 440 miles at 53 miles an hour; and the remarkable record of this train not only for speed but for punctuality, is to be credited to Mr. Voorhees more than to any other man.

The record of the Reading and the Central of New Jersey for high speeds and punctuality, between Philadelphia and Jersey City, which also is in many respects unique in the records of American railroad operation, was begun before Mr. Voorhees went there, but his has been the guiding mind during the twenty years in which this fast-train service has been so greatly improved. These trains, one every hour in each direction, all day, with their high speeds and freedom from delays; their good accommodations and the taste manifested in all the appointments, constitute a notable example of excellent service rendered to the public at what are really very low rates; one which deserves to be classed as a monument to the men who have carried such elaborate plans to successful execution. When Mr. Voorhees came to Reading, the Philadelphia & Reading's railway earnings amounted to $22,986,000. In 1913 the total earnings amounted to $50,563,000.

Refrigerator Cars on the French Railways.—It is estimated that there are but 200 refrigerator cars available for public use in France. All of these with the exception of 33 owned by the government and operated on the state railways are owned by private transportation firms with offices at Paris. There are also 149 cars owned and used exclusively by a number of brewing companies and about 30 belonging principally to the milk and butter dealers' co-operative societies in the Charente district. The railway companies also lease ordinary cars to private individuals who fit them out as refrigerator cars, but the private railway companies do not own any regular refrigerator cars. Usually the refrigeration is obtained by the use of ice, the amount of the latter necessary varying between one and two tons. As the journeys are not long re-icing does not become necessary. In about 80 cars, all owned by one of the private transportation companies, mechanical refrigeration is obtained by the use of a liquified gas, methyl chloride, produced by small machines placed in compartments occupying about one-fourth the total car space. The principal commodities transported are meat and fish, but milk and butter are also carried in large quantities. There are also large shipments of flowers and early vegetables and fruits from southern France. These are usually carried in special cars provided with casement windows which are closed in winter and open in summer. The Paris, Lyons & Mediterranean owns over 1,800 such cars. On the whole, the facilities in France for transportation under refrigeration are somewhat out of date.

ACCIDENT BULLETIN NO. 49

The Interstate Commerce Commission has issued quarterly accident bulletin No. 49, containing the record of railway accidents in the United States during July, August and September, 1913. The number of persons killed in train accidents was 211, and of injured, 4,011.

The total number of casualties of all classes reported, including industrial accidents, amounted to 3,173 killed and 56,642 injured. The accidents are summarized as follows:

Table No. 1—Casualties to Persons—Steam Railways

Causes	Passengers		Employees (including employees not on duty)		Other persons (trespassers and non-trespassers)		Total persons	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Train accidents								
Collisions	27	1,364	62	680	10	23	99	2,067
Derailments	6	1,086	80	548	23	59	109	1,693
Miscellaneous, including boiler explosions	..	13	3	237	...	1	3	251
Total	33	2,463	145	1,465	33	83	211	4,011
Other than train accidents								
Accidents (212) to roadway or bridges not causing derailment	..	...	...	1	...	...	...	1
Other accidents (classes C-3 to C-12, inclusive)	63	2,564	717	13,430	2,050	3,758	2,830	19,752
Total	96	5,027	862	14,896	2,083	3,841	3,041	23,764
Industrial accidents to employees								
While working on tracks or bridges	..	...	50	8,043	...	...	50	8,043
At stations, freight houses, engine houses, etc.	..	...	19	7,205	...	...	19	7,205
In and around shops	..	...	26	15,455	...	...	26	15,455
On boats and wharves	..	...	5	531	...	...	5	531
At other places	..	...	32	1,644	...	...	32	1,644
Total	..	...	132	32,878	...	...	132	32,878
Grand total	96	5,027	994	47,774	2,083	3,841	3,173	56,642

Table No. 1A, following, presents comparisons with the records in the bulletin next preceding and the bulletin covering the corresponding quarter of the previous year.*

Table No. 1A—Condensed Summary of Fatalities

No. Item	Bulletin No. 49	Bulletin No. 48	Bulletin No. 45
1—Passengers killed in train accidents	33	21	88
2—Passengers killed, all causes	96	64	156
3—Employees (on duty) killed in train accidents.	141	101	153
4—Employees (on duty) killed in coupling	42	46	32
5—Employees (on duty) killed, total	759	628	712
6—Total passengers and employees (items 2 and 5, above)	855	692	868
7—Other persons killed (including trespassers, nontrespassers, and employees not on duty), all causes	2,186	1,746	2,127
8—Employees killed in industrial accidents	132	97	114
Grand totals (items 6, 7, and 8)	3,173	2,535	3,109

The total number of collisions and derailments reported for the quarter was 3,913 (1,634 collisions and 2,279 derailments), of which 173 collisions and 223 derailments affected passenger trains; damage to roadway and equipment, $3,239,159. These are classified as follows:

Table No. 2—Collisions and Derailments

No.	Classes	Number	Killed	Injured	Damage to road and equipment
	Collisions—				
1	Rear	279	35	813	$409,067
2	Butting	139	31	571	220,825
3	Trains separating	130	2	28	58,702
4	Miscellaneous	1,086	31	655	514,422
	Total	1,634	99	2,067	$1,203,016
	Derailments due to—				
5	Defects of roadway	398	19	459	$301,498
6	Defects of equipment	1,144	24	437	969,157
7	Negligence	133	6	156	93,597
8	Unforeseen obstruction	81	19	124	163,465
9	Malicious obstruction	15	2	28	22,028
10	Miscellaneous	508	39	489	486,398
	Total	2,279	109	1,693	$2,036,143
	Total collisions and derailments	3,913	208	3,760	$3,239,159
	Total for same quarter of—				
	1912	3,935	276	4,100	$3,366,401
	1911	3,034	189	3,776	2,533,170
	1910	3,130	303	3,352	2,871,501

*Preceding bulletins have been noticed in the *Railway Age Gazette* as follows: No. 48, March 6, 1914, page 468; No. 47, October 24, 1913, page 759; No. 46, August 29, 1913, page 383; No. 45, June 6, 1913, page 1225.

The usual tables are given, classifying certain accidents in detail.

Eighteen accidents occurring during this quarter were investigated by the inspectors of the commission and the reports of these investigations fill 36 pages of the bulletin. The accidents occurred as follows:

Missouri Pacific	Berger, Mo.	July 2,	Derailment
Michigan Central	Jackson, Mich.	July 13,	Butting collision
Pacific Electric	Los Angeles, Cal.	July 13,	Rear collision
Michigan Central	Francisco, Mich.	July 15,	Derailment
Duluth & Iron Range	Colby, Minn.	July 22,	Butting collision
Lehigh Valley	Slatington, Pa.	July 27,	Rear collision
Pennsylvania	Tyrone, Pa.	July 30,	Rear collision
Great Northern	Allouez, Wis.	July 31,	Collision
Minn., St. P. & S. S. M.	Waukesha, Wis.	Aug. 5,	Butting collision
Chicago, R. I. & Pacific.	Richfield, Neb.	Aug. 12,	Rear collision
Baltimore & Ohio	Rowlesburg, W. Va.	Aug. 13,	Butting collision
Vandalia	Otter Creek Jctn., Ind.	Aug. 27,	Butting collision
Oregon Short Line	Banks, Idaho	Aug. 31,	Derailment
Chicago, R. I. & P.	Maynard, Iowa	Sept. 1,	Derailment
N. Y. N. H. & H.	North Haven, Conn.	Sept. 2,	Rear collision
Chicago, Mil. & St. P.	Penfield, Mont.	Sept. 4,	Butting collision
Minn., St. P. & S. S. M.	Adams, N. Dak.	Sept. 6,	Rear collision
Long Island	College Point, N. Y.	Sept. 22,	Butting collision

Electric railways reporting to the commission (not included in the foregoing statistics) had 170 persons killed during the quarter and 2,052 injured; and there were 41 collisions and 31 derailments. Train accidents are charged with 16 fatalities. The total number of passengers killed from all causes was 31, and of employees 14 (6 in industrial accidents). The number of trespassers struck or run over by cars was 75 (45 killed and 30 injured).

EASY ARGUING

[From the Saturday Evening Post.]

In the pages of the Congressional Record we find this—and, with some variation of details, much the same stuff is repeated there several times:

The railroads of the United States are capitalized at twenty billion dollars, on which they earn five per cent. a year; but they are capitalized at twice their true value. The government can buy them at their true value, borrowing the money for that purpose at three per cent., and make a sure, immediate profit of the difference between twenty billions at five per cent. and ten billions at three per cent., which would come to seven hundred million dollars a year, or nearly enough to pay its running expenses.

Except that the railroads do not earn five per cent. on twenty billions, are not capitalized at twice their value, and the United States could not borrow ten billions, or anything like that sum, at three per cent. interest, this argument is unanswerable.

The New Icelandic Railroad.—The plans for the first railway in Iceland are now being worked out. The line will be of narrow gage and will run from Reykjavik, the capital, through the Thingvalla district—the most fertile portion of the island to Rangavalle, a distance of about 64 miles, with a branch to the port of Eyrarbakki, an additional 12 miles. The territory which it will serve is very hilly, but since the line is to be built quite cheaply the boring of tunnels will be avoided wherever possible. There will have to be a great many bridges, therefore crossing the many streams. These bridges will have to be exceedingly strong, because during summer many of the rivers are raging torrents. The entire cost of the line is estimated at $968,000, or about $13,440 per mile. The station at Reykjavik will cost but $14,000.

One Road's Answers to the Commission's Questions 42 to 45

The Pittsburgh & Lake Erie Describes Economies Resulting from Large Capacity Cars and Heavy Locomotives

Questions 42 to 45, sent out by the Interstate Commerce Commission in its rate advance investigation of efficiency, were as follows:

Question No. 42.—By what amount has the respondent's investment in equipment been increased or decreased by reason of the introduction and use of heavier types of locomotives and cars, comparing the present investment with that which would have been necessary to transport the tonnage of the year ended June 30, 1913, with equipment of the types used in 1903?

Question No. 43.—(a) What investigation has been made by the respondent to determine the relative cost of maintaining the heavier locomotives of high tractive power and cars of larger capacity, as compared with the cost of maintaining locomotives and cars of lighter capacity; also as to the relative cost of maintaining all-steel or steel underframe cars as compared with all-wooden cars? (b) By whom was this investigation made? (c) Give fully such figures as have been compiled as the result of such investigation and the basis for them.

Question No. 44.—What investigation has been made to determine the relative transportation cost per unit of transporting freight in trains hauled by locomotives of high tractive power and cars of large capacity, as compared with the costs for transportation in the types of equipment used in the year 1903?

Question No. 45.—(a) What investigation and what showing of advantage or disadvantage has been made in the relative cost per unit, including both transportation expenses and maintenance expenses, of the change of policy which brought about the use of locomotives of greater weight and tractive power and cars of larger capacity? (b) By whom was this investigation made?

The answer to these questions for the Pittsburgh & Lake Erie was prepared by L. H. Turner, superintendent of motive power, at the direction of Colonel Schoonmaker, chief executive officer. The substance of this answer is given below.

When in 1896, Colonel Schoonmaker assumed active control of the operation of the Pittsburgh & Lake Erie, 24,758 trains were required to haul the tonnage an average of 66.96 miles, or 68 trains for each day in the year, with considerably less than one half the road laid with double track. At that time, the road was equipped with 50 ton locomotives, and a maximum capacity of 1,500 gross tons [behind the draw bar] per train. The freight cars were mostly 30,000 lb. and 50,000 lb. capacity cars.

The first step taken was to correct the weak spots in the physical condition of the road, at that time laid with 71 lb. rail, with culverts and bridges unsuited for heavier rolling stock. Within one year, or during 1897, locomotives with 60 per cent. increased capacity were placed in service, and while the replacement of locomotives was but partial, the increase in the average revenue tons per train was 30, or nearly enough increase in revenue to pay the locomotive service.

During 1897 the first practical steel hopper car was designed and built. This car is still in service, and has been the cause of more litigation than any other car constructed in this country, owing to the design of "built in" body bolster, which has been copied by every steel car manufacturer engaged in the work since 1897.

By the introduction of steel cars, and further increase of the new standard freight locomotive, the average revenue train load was increased 298 tons, or 65.8 per cent., during the year 1900.

In 1903, the revenue train load had increased 498 tons, or 109.9 per cent. above the performance of 1896. By this time, 100,000 lb. capacity cars were being introduced, and in order to meet the new conditions, a freight locomotive of 40 per cent. greater efficiency was built, and during the next three years, or by 1906, the revenue train load had increased 694 tons, or 153.2 per cent.

By the elimination of all types of light equipment and the substitution of the heavier classes, an increase of 760 tons per train was made in 1913, or 163.4 per cent., since 1893. The following table will give a clear idea of what has transpired within twenty years in intervals of four:

Year	Tons per train	Total tons hauled	Gross earnings
1893	465	7,649,189	$3,967,548.32
1897	483	10,015,971	4,581,417.96
1901	758	17,737,295	8,003,863.12
1905	1,076	24,900,574	12,837,735.83
1909	1,192	28,232,491	14,838,947.56
1913	1,225	35,359,444	19,597,918.74

This transition from light rolling stock to heavy was accompanied by a multitude of changing conditions that have presented themselves, including over 100 per cent. increased cost in the equipment, and a complete rebuilding of the roadway and bridges, the latter costing $4,362 per mile of road. Large expenditures on equipment to meet government requirements, nearly 100 per cent. advance in cost of maintenance of locomotives, with over 50 per cent. increase in wages of engine and train men, make up a large additional expense to be overcome through the medium of a larger revenue train load.

The greatest source of economy in modern railroad operation is the "steel car." The wood car of twenty years ago carried twenty tons, and its light weight represented 37.5 per cent. of weight of car and load. The latest design of steel car carried on 5½ in. by 10 in. axles, carries a load of 60 tons, and its light weight represents but 24.6 per cent. of the car and load, and while the earning capacity has been increased 200 per cent., the maintenance cost will never be more than 20 per cent. above the old light capacity car.

Although the purchase price of the large locomotive has advanced about 150 per cent., its maintenance cost about 100 per cent., and the consumption of fuel increased 43 per cent., the following table will demonstrate its part in reducing cost of train operation. This table is based on cost of 1,000,000 "Loaded Ton Miles."

1893		1913	
Enginemen's service	$116.04	Enginemen's service	$60.56
Firemen's service	69.62	Firemen's service	38.54
Cost of fuel	120.48	Cost of fuel	163.55
Repairs	83.33	Repairs	53.61
Lubrication	2.20	Lubrication	2.17
Small stores	1.96	Small stores	1,84
Total	$393.63	Total	$320.27
Revenue tons per train	408	Revenue tons per train	1,225
Revenue tons for the year	7,649,189	Revenue tons for the year	35,359,444
Trips required for 1,000,000 ton miles	37.5	Trips required for 1,000,000 ton miles	12.5
Value of locomotive	$7,000.00	Value of locomotive	$18,500.00
Interest on locomotive @ 5 per cent., 37.5 days	$36.00	Interest on locomotive @ 5 per cent., 12.5 days	$31.62
Depreciation on locomotive @ 5 per cent., 37.5 days	$36.00	Depreciation on locomotive @ 5 per cent., 12.5 days	$31.62
Conductor's service	$97.50	Conductor's service	$45.00
Flagman's service	$71.25	Flagman's service	$30.36
Brakemen's service (2)	$134.80	Brakemen's service (2)	$58.08
Total	$303.55	Total	$133.44
Total expense per 1,000,000 ton miles	$697.18	Total expense per 1,000,000 ton miles	$453.71

The statement has been made that the steel car has proved to be the greatest source of economy in modern railroad operation. This statement should be qualified by saying: "In proportion to the capital invested in the vehicle," which we believe is clearly

shown in the table following, giving the cost, maintenance and earning value as between the light capacity wood car and the heavy capacity steel car.

1893		1913	
Cars operated	6,897	Cars operated	21,027
Average capacity in tons per car	20	Average capacity in tons per car	44
Total tons handled during year	7,649,189	Total tons handled during year	35,359,444
Tons handled per car per year	1,109	Tons handled per car per year	1,835
Earnings per car per year	$496.26	Earnings per car per year	$811.31
MAINTENANCE COST			
Average value of cars (each)	$390.00	Average value of cars (each)	$1,017.74
Cost of repairs per car	57.14	Cost of repairs per car	62.79
Interest per car per year @ 5 per cent	19.50	Interest per car per year @ 5 per cent	50.89
Depreciation per car per year @ 4 per cent	15.60	Depreciation per car per year @ 4 per cent	40.71
Net earnings per car per year	$404.02	Net earnings per car per year	$725.23

The impression should not be gained that the building up and the successful operation of a great railroad with heavy tonnage and large earnings, consists simply in investing in heavy equipment and improved roadbed. These changes, while valuable in themselves, build up many other conditions that demand immediate attention in the way of new and better facilities for the care of the large engines and cars, which, if neglected, leave the railroad in a much worse condition than it was in before the change was made. New shops and improved tools are just as essential as the engines and cars, and to derive the full benefit, a sufficient amount of rolling stock must be furnished so as to be able to retire from service such units as are in need of attention, and in condition to cause delay to other trains, and which cannot deliver the maximum of service.

No engine incapable of handling the maximum train load is permitted to hamper the efforts of others. A sufficient number has been provided so that when one becomes defective, it is repaired at once, and no defect is permitted to continue and thereby create others, and in this way multiply the cost of maintenance.

Shops amply large for any locomotive or car owned by the company, equipped with the latest improved machinery, are at the disposal of the Mechanical Department, and through this medium, large sums are saved annually that are in too many instances wasted, all of which helps to reduce the net income.

No machine is perfect with even one broken cog, and neither is the operating department of a railroad perfect unless every member, from the general manager to the switch tender, works in harmony as part of one machine, and pulls the same way at the same time. The slogan of every officer of the transportation department is "lower cost of transportation," and the result of their labors appears in the annual reports issued by the company.

One of the most important ends to be attained by the adoption of heavy equipment is the increase in capacity of the line, without a corresponding increase in the number of trains upon the road, and the consequent necessity for more tracks. In the year 1893, the Pittsburgh & Lake Erie employed 44 locomotives and 6,897 cars to move the tonnage. Had this type and capacity of equipment been perpetuated, it would have required 203 locomotives and 31,885 cars to move the business of 1913, while as a matter of fact, the tonnage was moved by 88 locomotives and 21,027 cars employed daily; while the number of tons hauled in 1913 was 320 per cent. greater than in 1896, the increase in the number of trains was only 20.5 per cent.

Although the freight traffic presents some very interesting facts, the growth of passenger business within the last twenty years should not be overlooked. During 1893, there were carried 1,581,448 passengers, producing a revenue amounting to $544,820. During 1913, there were carried 4,935,070 passengers, producing a revenue of $1,825,282, an increase of 212 per cent. in number of passengers, and 235 per cent. in revenue.

In 1893, there were 372 miles of main track and sidings, and in 1913, 1,064 miles, or 186 per cent. increase.

COMPARATIVE LOSS AND GAIN BETWEEN LIGHT AND HEAVY EQUIPMENT

Loss	
Interest on capital invested in locomotives	$10,350.00
Interest on capital invested in cars	448,243.45
Increased cost of road bed (bridges, culverts, rails, etc.) per year, necessary account of using heavy capacity *freight* equipment	78,850.00
	$537,443.45
Gain	
In maintenance of locomotives	$69,571.31
In maintenance of cars	501,623.57
In enginemen's and firemen's service	197,183.68
In trainmen's service	387,510.58
	$1,155,889.14
Difference (saving for one year)	$618,445.69

CORRESPONDENCE FILING

By ROBERT W. CROSS
Executive Department, Southern Pacific Co.

In analyzing the workings of a correspondence file three factors must be considered. They are: the file clerk, the office force, the filing system. The first two may be taken as contributing about 80 per cent. of the total result.

To understand clearly the division of responsibility between these factors we may compare the file clerk to an engineer, the system to his engine, and the office force to the despatchers, trainmasters and all others who determine whether he shall have a good or a bad run. The system, like the engine, is of no use whatever without steam behind it and someone at the throttle. The file clerk, like the engineer, needs a level head and an alert mind, but it is after all the office force, like the trainmasters and despatchers, who determine whether he shall waste his time on a siding or make a record run on the main line.

Keeping this inter-relation of the three factors in mind, the first step in improving a file is to improve the conditions under which it works. Such minor things as proper equipment, ventilation and lighting are not to be overlooked if a thoroughly successful file is desired. Lighting is of especial importance to men who spend all their working hours reading over correspondence. Ventilation, too, is of considerable importance. A draft plays havoc with the loose papers in a file room and the windows are too often left closed on that account. A liberal supply of paper weights and of screens for all the windows will remove this difficulty.

Particular attention should be given the location of the file in relation to the offices which it serves. If necessary to have the file room at some distance from the other offices, a dictagraph or some form of telephone will be a time saver. In a large office there should be a regular distribution of mail between desks. This can be done by the office boys by having trays on each desk for incoming and outgoing mail.

The matter of equipment should be given careful scrutiny. Prices for this sort of office furniture are high, and it is only by care that the cost can be kept within a reasonable figure. First class vertical filing equipment in flexible units will be the cheapest in the end. The wear and tear on a file case filled to its maximum capacity is considerable and only well made equipment will stand the strain. The roller bearing cases which are coming into general use are a vast improvement on the old fashioned sliding drawer type. High-priced equipment need be used only for the current files, and matter seldom referred to may be placed in cheaper storage cases.

Having improved the conditions under which the file operates, attention may be turned to those who operate it. The ideal file clerk combines steady, methodical habits with a reasonable amount of initiative and imagination. But one must not overbalance the other. The file clerk who conceives brilliant ideas, but is slipshod in his routine work, is more dangerous than the fellow who goes on year after year following out-of-date methods. If a file clerk with the right combination of these

two qualities cannot be found it is better to take the man with methodical habits and place the supervision of his methods in other hands. Such supervision can often produce a measurable saving. The loss, direct and indirect, resulting from delayed correspondence, particularly in claim and complaint matters, the time lost by officers in waiting for files, the loss caused by misuse of equipment, lack of standardization and up to date methods if figured in dollars and cents by any railroad would amount to many dollars annually. The file clerk often sees where his system could be improved, but he has not the necessary authority to bring the improvement about; the chief clerk knows that there is something wrong with the files, but he has not the time to go into the problem. What is needed in such a case is an intelligent survey of the situation by an outsider who can consult with both the file clerk and the chief clerk and adjust any difficulties they may have.

The file clerk should be possessed of a good memory, but it should only be used as an aid in his work—too often it is the basis of his file. Obviously he must be honest and trustworthy. He must be possessed of a fair education, the more the better. It is too much to expect a man to find or file papers when he cannot understand the subject matter of the file. And above all the file clerk should be possessed of an unruffled mind and temper. The file clerk is always guilty until he proves himself innocent, and even in the best regulated office he is often in hot water. The man who understands that this is part of his business, and one of the things that he is paid for, is the one who generally succeeds. On account of this constant friction to which the file clerk is subjected, it is hard to get first class men for the place, and it is only by paying good salaries, as is now being done in the better class of offices, and opening the way for promotion to more responsible positions, that good men can be induced to take it up.

Having settled upon the personnel of the file force, we may consider the system to be used. In nearly every case where an effort is made to improve a file too much emphasis is laid upon the system. In the first place it seems the easiest way out of the difficulty. Discharging the file clerk would be unpleasant, and whipping the office force into line seems, and often is, well nigh impossible. So someone comes along and announces that there will be a change in the system. It sounds like an easy way out of the difficulty and is accepted with much gusto by everyone except the file clerk. But as a matter of fact it seldom hits at the root of the difficulty. This because it is based on the mistaken hypothesis that a good system means a good file. The system is nothing more than a tool. Installing a new filing system is comparable with adopting a certain make of typewriter for use in an office. The best typewriter will undoubtedly give the best service, but the typewriter is an inanimate thing, subject to those who use it. If the office boy writes letters on it, the typewriter cannot be held responsible for results. Neither can the typewriter be held accountable for the subject matter and grammatical errors in the letters which are written on it. No more can a filing system be held accountable for failing to produce results if it is operated by inferior help and dictated to by inefficient office men. Not only that, but like any other complex tool it must be adjusted to the purpose to which it is to be put. To expect the same system to operate in different offices without adjustment is absurd.

Correspondence files are of three general types: the alphabetical, the numerical, and the combination alphabetical-numerical. The alphabetical system is suited only to the small office. Under this method papers are filed either under the name of the person or territory involved. The numerical system is the one in most general use. Under it every file is assigned a definite number and the papers are filed away in numerical order. In the simplest form of this system the numbers assigned are purely arbitrary. For example, the first letter that comes in to the office might be assigned the file number "1," the second "2," and so on. In order to locate the correspondence the file clerk must keep a card record arranged alphabetically. For example a letter is received about boiler tubes. The file clerk assigns to it the number 2,346, and files it away under that number. He then makes out a card for his card index showing that that letter may be found under 2,346. The card he files under boiler tubes. As a further safeguard he will place other cards under locomotives, flues, tubes, etc.

The combination alphabetical-numerical file is based upon the theory that it is easier to file papers under the numerical system, but that they are more readily found under the alphabetical arrangement. To illustrate the simplest form of such a system: A number is assigned to every letter in the alphabet, "A" being "1," "B," "2," etc. A letter from John Barry, which under the alphabetical system would be filed under "B," will now be given the file number "2" and filed in numerical order. By expanding the number of alphabetical sub-divisions and making combination file numbers the system becomes applicable to the ordinary business concern. Combination file numbers are made by taking the initial letters of a firm name and combining their numbers. For example, a letter from the American Brewing Company would be assigned the file numbers from "A," "B" and "C" combined, or 123.

The Williams Railroad Correspondence File which is used by some railroads is primarily a numerical system, although it has certain alphabetical features. It is founded upon the Dewey Decimal Classification System, which is used by libraries throughout the country. In compiling his system Mr. Dewey read and carefully studied all available material on the subject and was assisted by over a hundred specialists. Working on this foundation the Williams System was built. It has the advantage over other systems in general use in that it allows of indefinite expansion and that papers relating to the same general subject are filed together.

In connection with any file there should be a system of suspense or tickler files to take care of correspondence which has not been closed out. Under the tickler system papers are brought automatically to the attention of the clerk handling on any predetermined date. There are various ways of running such a file. A common way is to have the stenographer make an extra copy of any letter requiring further attention and to file it away in a folder bearing the day of the month on which it should be brought up again. On any given day the carbons for that day are taken out and tracers are written, or if it is desired to give the correspondent a few days more of grace, the carbon is marked up for a later date, when it will again be brought to the attention of the clerk who wrote the letter. Another method is to index the files on cards, the cards being filed under the days of the month. Still another method is to keep the files containing unfinished matters in a case by themselves, usually arranged under the name of the person on whom the office is waiting for reply, or under the date on which the letter was written. Such a file has many uses beside keeping tab on unanswered letters. Important engagements may be noted on a piece of paper, marked at the top of the sheet with date on which the engagement is to be fulfilled and turned over to the file clerk. The file clerk will put it away in his tickler file under the date marked and take it out on the morning of that date. In the meantime, neither he, nor the man who has the engagement, need think of it again.

The third factor in the operation of any file, the office force, while the most important, must be dismissed with the fewest words. It is an individual problem and few special rules can be laid down. No two offices handle business in exactly the same way and it is the duty of the file clerk to make his system fit the prescribed routine as far as possible. But there comes a point beyond which the file clerk cannot go, and the office force from highest to lowest must make concessions to him if they desire efficient service. It should be obvious that a file held on a desk, stowed away in a coat pocket or endorsed out without a record, cannot be in the file and that the file clerk cannot be held accountable therefor—and yet more than once he and his system are adjudged inefficient because of this very thing.

To any office having trouble with its files the following course is recommended:

Satisfy yourself that you have an efficient file clerk and that you have given him the proper conditions under which to work.

Review the work that he is doing, and to make sure that he is not losing time by false motions or performing work which could be done by a cheaper grade of help. It is not an unusual thing to see a twenty-five dollar a week file clerk spending an hour a day opening mail.

Require every man in the office to clean up his desk and to rigidly follow the following fundamental rules:

First—Do not hold papers on your desk, or in any place except the file room. Let your tickler system take care of unfinished business.

Second—Do not endorse papers out of the office without making a record for the file clerk.

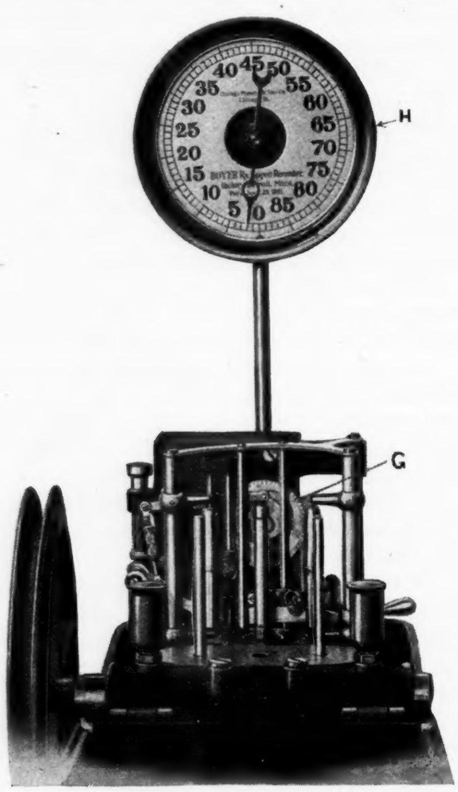
If these two rules are followed, in nine cases out of ten there will be no need for expensive changes or new systems, but if they are not followed all the systems in the world cannot make a file room truly efficient.

CAST STEEL BUMPER WITH FRICTION DRAFT AND BUFFING GEAR

An arrangement of friction draft and buffing gear with a short pivoted coupler incorporated in a cast steel locomotive bumper beam is shown in the illustration. This has been developed by the Gould Coupler Company, Depew, N. Y., and is such that the capacity of the draft and buffing gear may be reduced below the maximum capacity, if desired. This is accomplished by removing some of the plate springs and inserting in their place shims or plates to take up the slack. The plate springs are removed or replaced through a pocket in the bottom and when in position are retained by a cap bolted over the pocket. The short coupler shank engages with the front wedge and in buffing this wedge is carried backward by the coupler shank and forces out the two side wedges which are held from movement toward the rear by the back follower abutting shoulders in the buffer casting. In a pulling movement the front wedge shoulders against the forward portion of the buffer casting and the rear follower is pulled forward by the yoke which moves the side or rear wedges forward against the front wedge and the resistance is obtained from the plate springs. All of the parts, with the exception of the plate springs, are inserted through the opening for the coupler shank and the yoke in the front portion of the casting. It is claimed that this arrangement of friction gear and buffer is entirely satisfactory in operation and has given efficient service.

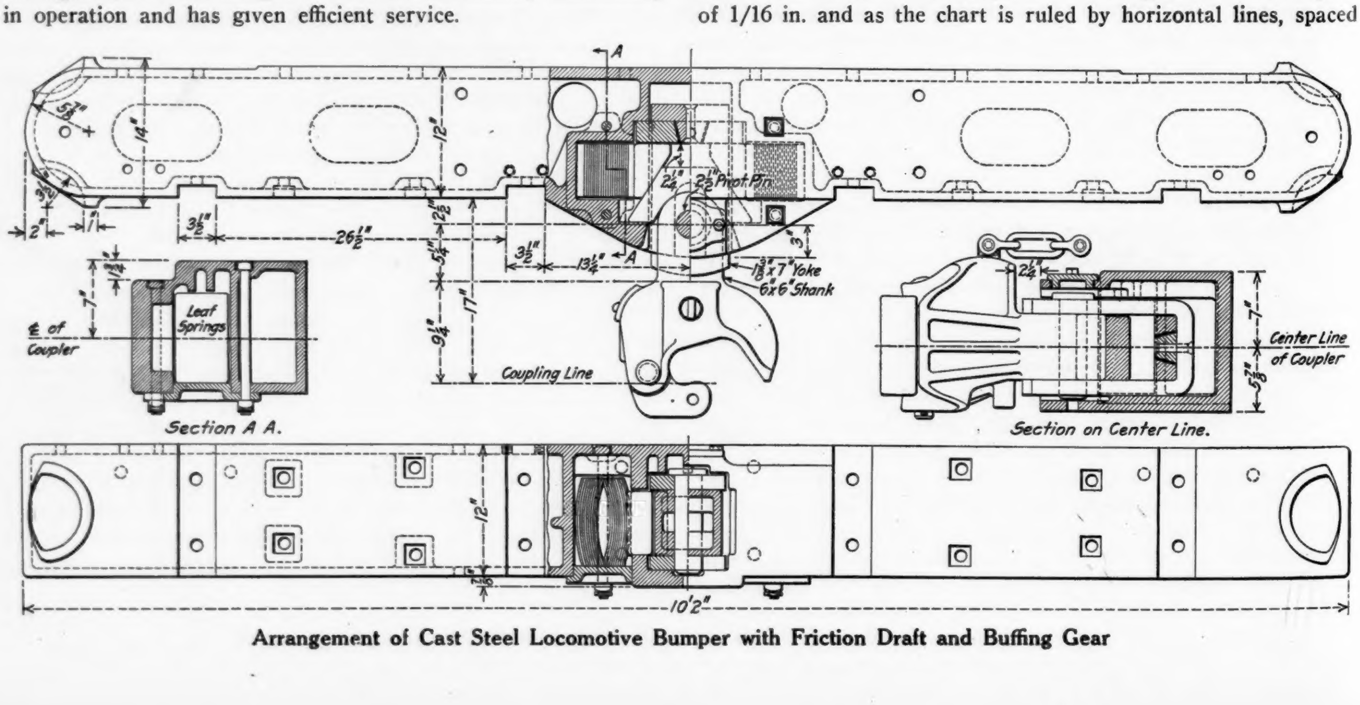
CLOCK ATTACHMENT FOR BOYER SPEED RECORDERS

An improvement in the present Boyer speed recorder has been made in the shape of a clock attachment by which it is possible to record the time by means of a curve in a similar manner to the recording of the speed. This clock attachment forms a part of the speed recorder itself and is enclosed in the hood that covers the machine. The new speed recorder differs from the original in no way other than the addition of the clock attachment. The pencil for the time curve is driven by a cam *G*, as shown in the illustration, which makes a complete revolution



Boyer Speed Recorder with Clock Attachment

every hour. The pencil moves vertically and is so adjusted as to travel 1⅞ in. down and 1⅞ in. up for every complete revolution of the cam, or for every hour. This gives a minute space of 1/16 in. and as the chart is ruled by horizontal lines, spaced



Arrangement of Cast Steel Locomotive Bumper with Friction Draft and Buffing Gear

5/32 in. apart, one line being a heavy line and the other dotted, the distance between the heavy lines represents five minutes. In order to avoid confusing the speed curve with the time curve the time pencil has been located 1½ in. in advance of the speed pencil.

The accompanying chart is a typical record taken with this new recorder. The mile posts, or the vertical lines, are numbered from 0 to 28, inclusive. The horizontal lines are lettered in this case simply to facilitate the description of the operation of the new recorder, a point on the chart being represented by a letter and figure. The interpretation of this chart is as follows: The engine was in the roundhouse at 4:05 p. m., the clock pencil being at R-6, while the speed pencil was at S-3. The point R-6 was then marked 4-5 p. m. by the inspector, and the top of the recorder was then closed and locked. From the engine house the engine was backed down to its train, a distance of three miles. The time it left the roundhouse is shown by the point L-6, which being three spaces down from R-6 indicates that it

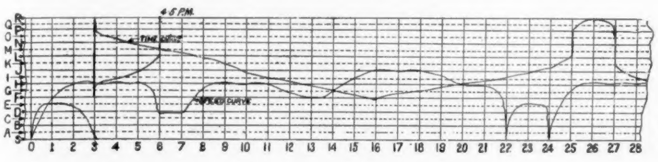


Diagram Made by Boyer Speed Recorder with Clock Attachment

was 15 minutes before the engine left the engine house after the inspector had set the time pencil. The engine arrived at the terminal at 4:32½, being 12½ minutes on the road. While at the terminal the time pencil traveled from G-3 to F-3, then to R-3 and back to P-3, indicating that engine was idle 37½ minutes, and that its leaving time was 5:10 p. m. On pulling out, the speed of the engine was increased in two miles to 40 m. p h. This speed was maintained but 3½ miles, as there was a slow order between mile posts 6 and 7, on account of which the engineer slowed down to 20 m. p. h. as shown between D-6 and D-7.

The speed was again increased to 40 m. p. h. which speed was maintained until 11 miles out, or at 8:11. A grade of 2½ miles slowed the train down to 30 m. p. h. From the time curve the foot of the grade was reached about 5:27½ p. m. On starting down the other side of the grade the speed was increased until at 16 miles from the terminal, 50 m. p. h. was reached. Twenty-one miles out the engineer shut off and coasted, then applied the air and came to a full stop. The time curve then showed that he was held 10 minutes, as shown by the points L-25 and P-25. The engine was started at 6 p. m. and ran two miles to the station, where a 10 minute stop was made. The station was left at 6:17½ p. m.

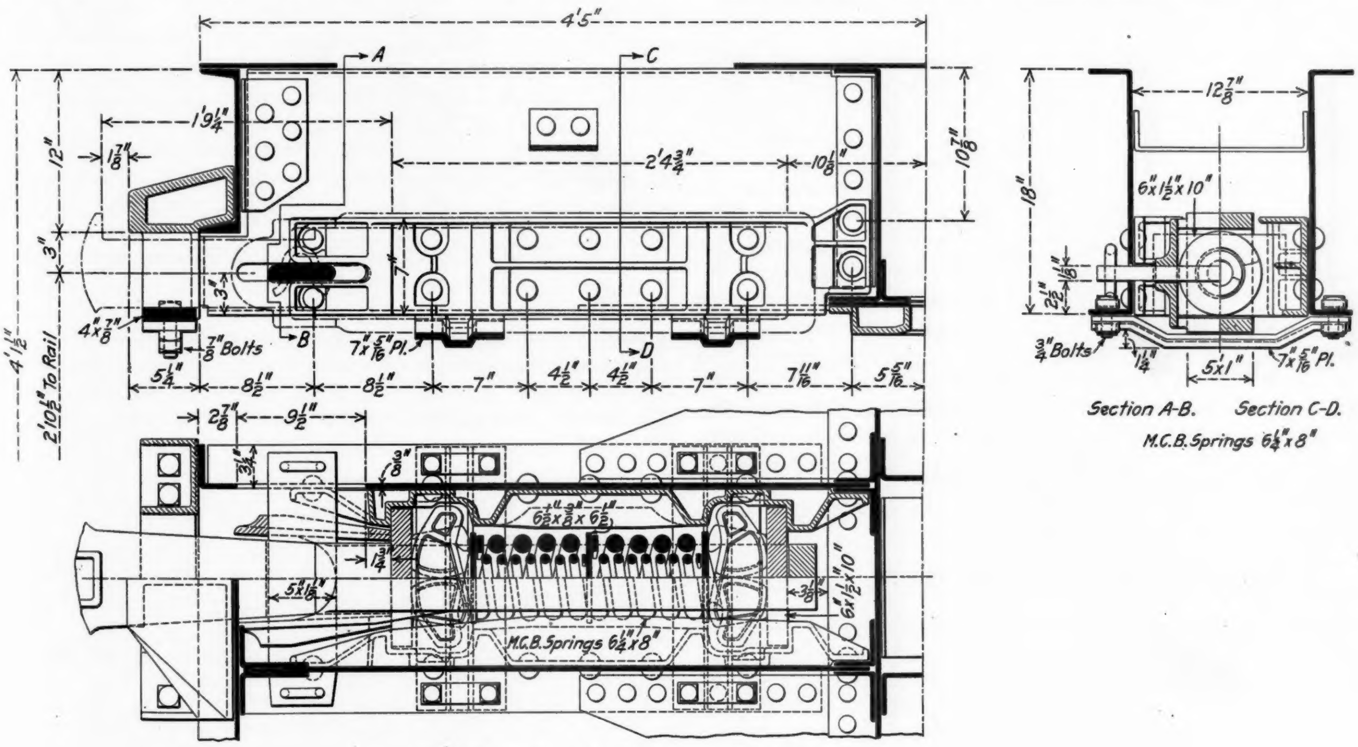
With this attachment it is now possible by means of the Boyer speed recorder to record the speed in miles per hour at all points of the trip, the total mileage between any points, the actual running time between points, the total time on the road, the time and location of each stop or slow-down, the time consumed at each stop, and the time and location of each brake application. By means of this device it is possible to tell in detail the movement of a train over a division, and positive check on the operation of the train is provided.

The Boyer speed recorder is sold by the Chicago Pneumatic Tool Company, Chicago, Ill.

YOST DRAFT GEAR

The Yost lever friction draft gear, which is shown in the engravings, has been under development for several years and is now in service on about 2,000 cars. The gear is manufactured by the Hart-Otis Car Company, Limited, Montreal, Que., and is formed by placing friction levers between the followers and springs of a spring gear. It consists of four parts, the lugs, the levers, the springs and the followers. The springs are 6¼ in. by 8 in. M. C. B. standard, and the followers are the standard for spring gears.

In the operation of the gear the resistance is slight at the start of the travel and gradually increases until the full travel is attained. The recoil is low but is sufficient to release the gear. It is claimed that the action is smooth and gradual at all points of the travel and the change from spring to spring and lever action is so gradual that it cannot be noticed. For the first ⅜ in. of travel, the friction levers move bodily, giving the spring a free action. This gives the equivalent in resistance to the old 6¼ in. by 8 in. spring gear to this point. The reason for mak-



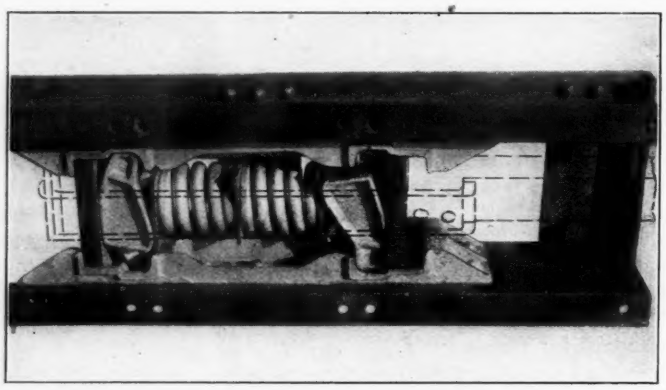
Yost Draft Gear Applied to a Steel Underframe Car

ing this initial travel low is to allow the engineman to start a long train without having to bunch the slack.

From ⅜ in. of travel, the friction levers begin to rotate, increasing from 9,800 lb. at ⅜ in. travel to 22,500 lb. at 11/16 in. travel, which, up to this point, is the equivalent in resistance of the G spring gear. The balance of the travel is a gradually increasing resistance up to 300,000 lb. at the extreme travel. This resistance is made possible by the lever action between the coupler, draft lug and springs, together with the friction caused by the movement of these parts.

During the entire movement of the coupler, the spring compression is proportional to the travel of the friction levers and the spring cannot become solid, as it has still ¼ in. free motion when the final travel of the coupler is reached. This, it is claimed, not only greatly increases the life of the spring, but makes the gear self-adjusting as wear takes place.

The levers are so shaped that when extreme travel is reached, all moving parts form a rigid abutment transmitting the force



Yost Draft Gear with One Set of Levers Compressed

beyond the capacity of the draft gear to the car. The spring compression during the last ⅛ in. of coupler movement is ¾ in.

In buffing, the blow acts directly on the draft gear through the coupler, and not on the yoke. The yoke only comes into action in pulling. This allows a free swivel movement of the yoke for any side movement of the coupler, preventing the shearing of the yoke and coupler rivets.

The levers are designed to give a leverage in compression but none in recoil. The action of the gear in recoiling is the reverse of that in compression, except that the levers, being free to move bodily, have no lever action. The power returning the gear to normal position is that of the compressed spring (19,000 lb.). The spring bearing on the inner end of the levers while the outer ends are free, it is claimed, makes it impossible for the levers to stick, become displaced, or return to any position other than normal. The levers are alike for all types of the gear and are interchangeable.

TWO-COLOR CROSSING-GATE LIGHT

The red-lamp arrangement for highway crossing gates recently put in use on the Lehigh Valley has been noticed already in the *Railway Age Gazette*. The arrangement of the light is shown in Fig. 1, printed herewith, and the hanger and bracket for supporting the lamp and the red roundel are shown in Fig. 2.

When the crossing gate is lowered (A Fig. 1) the red light shows on the highway, and continues to show until the gate is raised again. The change of lights occurs when the gate is at an angle of 35 degrees. The red glass is so fixed on the gate that it is immediately in front of the point where the lantern hangs when the gate is lowered. The roundel is fixed, while the lantern swings. As the gate comes down the lantern, which has been showing white, swings behind the roundel and shows red.

As the lanterns themselves are white, there are no red lights at the crossing except while trains are passing. The frame, bolted to the arm of the gate and holding the 6½ in. roundel, is of ⅜ in. iron, 1½ in. wide. The light is the company's standard crossing gate lamp, and it is suspended, pendulum fashion. The

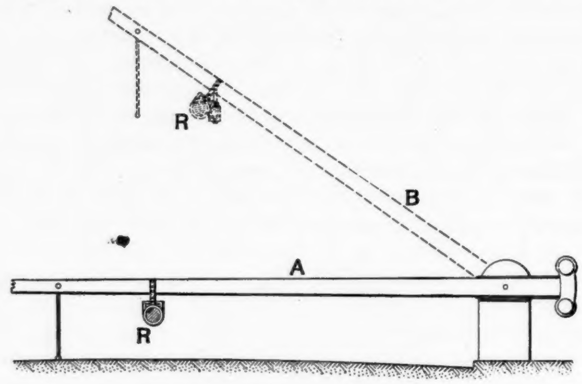


Fig. 1.—Lehigh Valley Crossing Gate

lamp is equipped with a hood, H, funnel shaped, so fixed that no light is seen from it by an approaching train. By arranging the fixtures at a proper angle on the gate arm so that the face of the light is at right angles with the highway there is very little

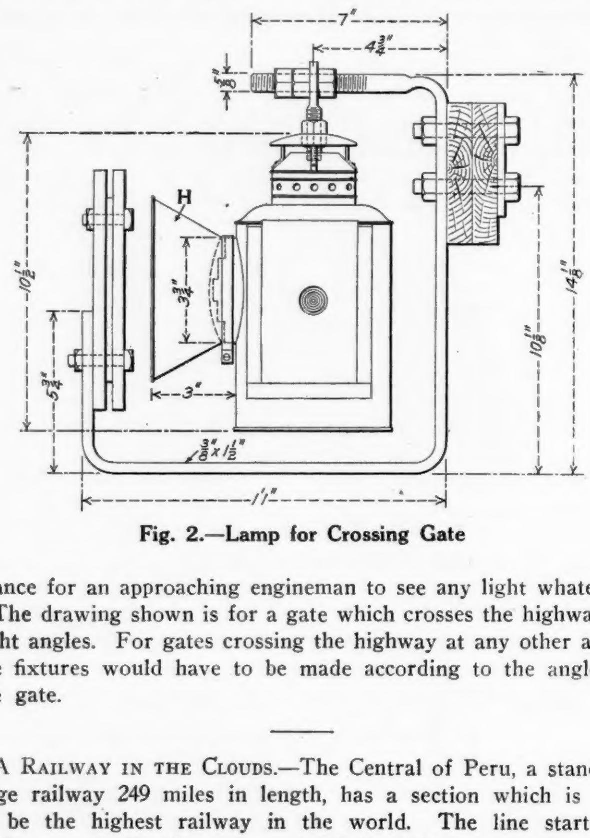


Fig. 2.—Lamp for Crossing Gate

chance for an approaching engineman to see any light whatever.

The drawing shown is for a gate which crosses the highway at right angles. For gates crossing the highway at any other angle the fixtures would have to be made according to the angle of the gate.

A Railway in the Clouds.—The Central of Peru, a standard gage railway 249 miles in length, has a section which is said to be the highest railway in the world. The line starts at Callao, on the Pacific coast, and climbs without rocks from sea level to the Galera tunnel, pierced through the Andes at an elevation of 15,665 ft. It then drops to Oroya on the eastern slope, 12,180 ft. above sea level. This means that there are 106 miles of steady 4 per cent. gradient, 60 tunnels, 13 switchbacks and 67 bridges, including the "Infiernillo" or Little Hell spanning a deep gorge between vertical faces where the train emerges from one tunnel and crosses to another opposite. From Oroya the railway runs along a river valley to Huancayo, whence it is being built to Ayacucho to the south, eventually intended to be extended to meet a proposed extension of the Southern Railways from Cugio and thus form a link in the Pan-American Railway. The Central of Peru also has a Morococha branch which crosses the Andes at a height of 15,865 ft.

Maintenance of Way Section

With the rapid growth of the fruit, meat and other refrigerator traffic, the problem of the economical storage of ice to properly care for this business has become of importance. With the increased quantities of ice required, there has arisen a demand for more economical means of handling it, both when filling the house and when transferring it to the cars, either crushed or in cakes. At the same time the importance of reducing the shrinkage to the minimum has also been realized. As a result, a comparison of a typical house built today with one erected 10 or 15 years ago will show a marked development. Probably the most advanced type of ice house built for railway purposes so far is that of the Northern Pacific at Pasco, Wash., with double concrete walls and cork insulation, described in the *Railway Age Gazette* of January 23, 1914. But frame structures such as those recently built by the Chicago & North Western and described in this issue are of the type more generally found and are of more general application. With the further rapid increase in this refrigerator traffic, which it is reasonable to expect, the subject of ice house design will become one of even greater importance. This is another of the many specialized problems with which the railway engineer must continually deal.

Ice House Design

In the Maintenance of Way Section for April we called attention to the fact that the derailments due to defects of roadway and track are increasing faster than the total number of derailments due to all causes and much faster than the traffic. As satisfactory statistics regarding this matter have been published by the Interstate Commerce Commission since 1905, any study of the matter is limited to the last nine years. Within this period there has been a very general increase in the number of derailments except in 1908 and 1909, and the increase has been very marked during the last two years. As a result the total number of derailments was 68 per cent. greater in 1913 than in 1905, while those due to defects of roadway and track increased 98 per cent. It is interesting, in this connection, to note the relative increase in the number of men employed. For the five year periods ending with 1896, 1901, 1906 and 1911, the average numbers of men employed on track work per 100 miles of line were 113, 125, 162 and 164 respectively. Thus, while the number increased 37 in the five year period ending with 1906 as compared with the previous period, the succeeding five years showed an increase of only two men. During these same two five year periods, revenue train miles increased about 16 per cent. This almost complete arrest of the increase in the number of men employed on maintenance work in the face of increasing traffic undoubtedly accounts for a large share of the increase in the number of derailments, and is a direct result of the retrenchment in maintenance expenditures.

Number of Men Employed and Derailments

The uniform lining of curves is essential to smooth riding track and is a goal towards which all roads strive to a greater or less degree, depending upon the importance of their passenger traffic. The means by which they attempt to maintain correct alinement vary widely. On many roads the curves are lined by eye by the foremen, or the engineering department is called upon to set center stakes, which are soon knocked out or broken off. On a few roads missing stakes are promptly reset so that the track foremen may keep the track in proper line at all times. On other roads the ends of the curves and perhaps one or two intermediate points are permanently marked by rails or other monuments and the foremen are relied upon to line the track between these governing points. The method outlined by Mr. Rench in another column, whereby the correct line is determined by means of the middle ordinates from a string of known length is not generally known but has several important advantages. In the first place, the supervisor is able to line his track at his convenience without the necessity of calling upon men from another department. More important, however, is the ability to fit the curve at once to the track as it actually exists with a minimum of track throwing, a point the importance of which it is difficult to impress upon young engineers. While the particular method outlined by Mr. Rench would perhaps appear at first glance to be somewhat complicated, it requires the attention only of the man making the computations after the deflections have once been secured, and this can be done in the office at any time that may be most convenient for such work.

The Lining of Curves

A SEPARATE WATER SERVICE DEPARTMENT

THERE is no feature of railway operation the practice regarding which will be found to vary more widely on different roads than in the providing of water for locomotive use. Different railways operating through the same part of the country and using the same general quality of raw water, will be found to supply it to the locomotives in all degrees of treatment or lack of it. Also, under the same general conditions, there will be found all kinds of sources of supply, from streams to reservoirs and deep wells. As a result, the cost and the quality of the water vary between wide limits. This condition is largely due to failure to have any one officer or department give concentrated attention to this subject.

On most roads the development of new supplies of water and the construction of water stations are assigned to the chief engineer or his immediate assistant as one of several duties, while the maintenance of the various stations is in charge of the supervisor of bridges and buildings, or some similar officer, whose principal duties and responsibilities are in other directions. As a result the attention is not given to the original installation that its importance deserves, and the local officers in charge of maintenance do little beyond keeping a steady corps of pumpers at the various stations. Under these conditions it is not surprising that little attention is paid to economical operation or to the development of the most satisfactory supply. This situation has arisen with the gradual development of the railway organizations and is due to a lack of a realization of the importance of maintaining a continuous supply of water at a minimum expense. Therefore, the opportunity for the adoption of more economical methods is great on many of the railroads of this country.

The offer of one prominent water service expert to take charge of this work on one of the largest systems for 10 per cent. of the total savings he would effect may be unusual, but it illustrates the opportunity for the improvement of present conditions by an engineer specializing in this field. These possible savings are not confined to the operation of the water stations, but are also shown to a very large extent in the greatly decreased cost of maintenance of locomotives. It is this latter saving which prompts careful studies of the quality of the water provided and of the method of treatment best suited to the local conditions.

Each water station presents a distinct problem, the proper solution of which is essential to the most economical operation.

The choice between the sources of supply, the kind of treatment, if any, the size and type of pumping units installed, the source of power for pumping, etc., are all of primary importance in securing the economical operation of the plant itself, as well as the least detrimental effect upon the locomotive. Even unusually large original expenditures to eliminate bad conditions may be justified by the great improvements effected. As an instance, one installation on a southwestern railroad costing several hundred thousand dollars is said to have paid for itself within two years from the direct savings alone and is now yielding an excellent return on the investment.

While the creation of further departments in railway organization is in general not to be advocated, a multiplication of the duties of individual officers with the necessarily resulting decrease in supervision is more undesirable. For this reason some roads, including the Illinois Central and the Missouri Pacific, have created a special branch of the engineering department with officers who are devoting their entire time to this one subject.

LIMITS OF BRIDGE AND TRACK LOADING

While the subjects of locomotive and car design are essentially mechanical department problems, the engineering department is vitally interested in the results of such design. Especially when building a bridge, the engineer is forced to anticipate the increases in the maximum loads which the structure will be called upon to carry during its life. Therefore, the subject of bridge loading always has been and probably always will be, one of vital interest to the bridge engineer. Different loadings have been adopted from time to time, and as each one has come into general use, prominent bridge engineers have predicted that structures designed in accordance therewith would safely carry any loads that might be placed upon them. In every instance a few years have been sufficient to see the successive predictions fail.

However, these forecasts are still made and it must be confessed with many convincing arguments. Added interest in this subject has been aroused by the reprinting of the paper by J. E. Greiner, first appearing in a bulletin of the American Railway Engineering Association over two years ago (see *Railway Age Gazette* of November 17, 1911), in a recent bulletin of this association with discussions by several prominent bridge engineers. In this paper Mr. Greiner takes the position that a bridge designed for a loading heavier than Cooper's E-50 loading is not justified, and that a structure designed for Cooper's E-60 loading will safely carry the heaviest load of which it is possible to conceive. These conclusions would appear to be very broad, especially in view of recent developments in locomotive and car design.

It is true that the increase in the weights of locomotives has not been as great in the last five years as in previous periods. This is explained partly by the fact that the constant demand for increased train loading on the part of the operating department has been met by improvements in the design of the locomotive itself, such as the superheater, the mechanical stoker, etc. However, these improvements cannot continue indefinitely, and a further increase in the weight of locomotives may be expected. In fact, the Baldwin Locomotive Works has recently completed for the Erie a triplex type locomotive with 24 drivers, weighing 853,000 lb., or 3,000 lb. more than the total weight of the engine and tender of the Santa Fe 2-10-10-2 type. An increase in the total weight of locomotives does not necessarily mean a corresponding increase in the axle loads, as in most cases this increase in weight is distributed over more axles, but in this instance, the average load on each of the 12 axles is 63,500 lb. Also, after several years of careful investigation and experiments, the Pennsylvania is now building a large number of Atlantic type locomotives which weigh 240,000 lb., with 133,100 lb. on drivers, or 66,550 lb. per axle. Partially to compensate for this heavy axle loading very careful attention was given to making the reciprocating parts as light as possible, and as a result the dynamic load due to counterbalance is less than 30 per cent. of the static weight on drivers, or less than that of many passenger locomotives with axle loads 10,000 lb. less.

Many engineers believe that the existing clearances will also retard future locomotive development, as, especially in the East, clearance limits are in many cases now closely approached. However, legislative and other influences are tending to increase the clearances on many roads, so this objection probably will gradually be removed.

Another element which engineers must consider, entering especially into the design of long spans, is the increase in the capacity of cars. The 100,000 lb. capacity car is now generally used. The 115,000 lb. capacity car is not uncommon, and the Chesapeake & Ohio has recently let contracts for 1,000 cars of 140,000 lb. capacity, while the Norfolk & Western built 750 gondola cars with a capacity of 180,000 lb. last year. These latter cars weigh 263,600 lb., with full overload, and give a maximum axle load of 43,900 lb. on the six-wheel trucks, while the C. & O. cars with four-wheel trucks will have a maximum axle load of 52,625 lb. Cars for special uses have been built of heavier capacities. The Lehigh Valley has recently completed three cars of 220,000 lb. capacity, which, with overload, give an axle load of 55,660 lb. While the latter cars are not a serious problem in themselves, as ordinarily only one such car will be in any train, those of the Norfolk & Western and Chesapeake & Ohio will very probably be hauled in solid trains, and under such conditions the effect produced by each car upon the track, roadbed and structures approaches that made by the locomotive itself.

It would seem from the above instances that the increases in the weights of locomotives and cars have not been arrested, and the indications are that they will continue, although perhaps not at the same rate as in the past. The engineer must, therefore, keep in constant touch with the developments in the mechanical department if he would forecast accurately and intelligently this growth. The premature removal of a structure because it is too light is expensive to his company as well as a reflection upon his design.

Another feature not generally considered in the operation of this heavy equipment is its effect upon the track, made evident in increased expenditures for maintenance. It is common knowledge that the adoption of heavier locomotives is followed by increased expense to maintain the track to the same standard. In the adoption of high capacity cars the ratio of dead weight to lading is decreased, and the percentage of revenue tonnage rises accordingly. However, this is not at all clear gain as is frequently believed, for as these heavy cars approach locomotives in their effect on the track, a portion of the revenue saved in transportation is required for maintenance. Recent exhaustive studies on two prominent roads to ascertain the effect of various types of equipment upon the track indicate that some of the newer designs of freight and passenger cars create surprisingly high stresses in the track, actually almost as great as those of the locomotives. The extent to which wheel loads can be increased with the present track construction is unsettled, but there are indications that this limit is being approached.

NEW BOOKS

Practical Treatise on Sub-Aqueous Foundations. **By Charles Evan Fowler. Size 6 in. by 9 in., 814 pages, 69 tables and 492 illustrations, cloth binding. Published by John Wiley & Sons, New York. Price $7.50.**

The first treatise on foundations by Charles Evan Fowler was issued in 1900 under the name of "The Coffer Dam Process for Piers." This work performed a service by bringing together descriptions of ordinary examples of foundation problems which had been given scant mention by engineering writers on account

of the greater interest attaching to the unusual and larger pieces of construction. The second edition of this book was issued in 1904, under the title "Ordinary Foundations Including the Coffer Dam Process for Piers." In this revision the scope of the text was broadened considerably to cover the construction of piers by the use of metal cylinders; with timber caissons by open dredging and the construction of ordinary size foundations by the use of pneumatic caissons. This work was intended both for the practicing engineer and for class room instruction. The third edition, which has just appeared under the title "A Treatise on Sub-Aqueous Foundations Including Ordinary Foundations and the Coffer Dam Process for Piers," was made the occasion for a still further broadening of the scope of the book. In addition to the subjects covered in the earlier editions, the new book treats of concrete piles, their construction and driving, the details of construction plants for jetting piles, the use of metal sheet piling, the open dredging process for foundation work, additional data on caisson work, a discussion of divers and diving, a brief discussion on the removal of old piers, general data on the use of launches, tugs and scows and considerable general information on the design of piers, retaining walls, dams, sea walls and locks. Two chapters on the cost of foundation work and a number of tables presenting some of the data in a novel form are features of the new book. A large part of the matter contained in the book is drawn from practical examples of work, much of which has been constructed under the direction of the author in his extensive experience as a consulting engineer. The work is divided into 33 chapters and 11 appendices, the arrangement and indexing making all of the information readily available.

Designing and Detailing of Simple Steel Structures. By Clyde T. Morris, professor of structural engineering, Ohio State University. Size 6 in. by 9 in., cloth binding, 260 pages, 94 illustrations. Published by the McGraw-Hill Book Company, New York City. Price $2.25.

"Steel Structures," by Morris, was first issued in 1909, the present edition being the third. A number of revisions have been made in the new book based on the experience of the author in class room work for the last four years. The arrangement of chapters has been improved, a new chapter on Highway Bridges has been added, together with a reprint of the Specifications for Steel Highway Bridges of the State Highway Department of Ohio. The original book sought "to collect from the many larger and more exhaustive works, the parts directly applicable to simple structures to make it possible for students in technical schools to learn to apply the simple laws of statics to the details of structures so that the resulting designs may be in accord with the stresses which are to be transmitted."

Inspection of Concrete Construction. By Jerome Cochran. Size 6 in. by 9 in., 595 pages, illustrated, cloth binding. Published by Myron C. Clark Publishing Company, Chicago. Price $3.

The author has covered a broad field in his endeavor to present in detail all important points with which an inspector on concrete construction work should be familiar. Beginning with a 16-page introduction covering the duties of a concrete inspector and the importance of proper inspection, the work takes up under carefully classified heads, the inspection of cement, sand, stone and miscellaneous concrete material, the proportioning and mixing of concrete, the inspection of forms, molds, centering and falsework, steel reinforcement, the process of concreting, the inspection of surface finishes for concrete, of waterproofing for concrete work, of concrete sidewalks, curbs and pavement construction and of concrete products, including the molding and driving of concrete piles. The book is divided into 60 articles, which are in most cases subdivided to secure a logical arrangement and due proportion between the various subjects. A glossary of terms used in concrete construction and an index are included.

Letters to the Editor

PREVENTION BETTER THAN CURE

CHICAGO, Ill., April 21, 1914.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In your issue of April 17, there is an interesting description of "An Unusual Method of Collecting Scrap," which was considered important enough to receive editorial comment, but apparently was not given the serious thought to which it was entitled.

The most striking feature of the article referred to is not the "unusual methods" which were employed, nor yet the results obtained by their use, but rather the fact that "unusual" methods were necessary, and that such results were possible. The tone of the editorial suggests the thought that such conditions are not uncommon and seems to indicate that "unusual" methods must be adopted in times of retrenchment to cure usual conditions. To my mind the bare statement of the case carries its own criticism of the usual methods which permitted the existence of the conditions described.

It does not argue well for the established practice or discipline that it should be possible to recover 147 car loads of unnecessary material from one division. The fact that a large proportion of it was scrap does not alter the significance of the situation. The money which it represented should have been made available promptly and regularly by the application of well established routine practice instead of a resort to "unusual" methods being necessary. "The directing of concentrated attention on this subject at frequent intervals," which is editorially prescribed, is an attack on the symptoms but not on the disease. The cure lies in the adoption of such practices with respect to the handling, distribution and control of all material which is not in actual use, as will prevent the growth of conditions that render such problematic "savings" possible.

In the editorial referred to, it is stated that although many roads operate scrap trains monthly, these are not entirely efficient without continued, careful supervision, and the points I wish to call to your attention are:

First:—That continued careful supervision should be a matter of every-day occurrence, particularly with respect to anything in connection with the use or handling of material for which the railroads expend more money every year than for any other item, except labor, and

Second:—That the most effective way of securing this continued and careful supervision is to entrust that duty to men who have no other work assigned to them and no other responsibility than to see that the interests of the company, as represented by unapplied material, are conserved to the greatest possible extent. In many cases this would only involve making the best use of the potential activities of the existing supply department organization; extending its powers to the point of actual, instead of nominal, control of all material that is not in use, regardless of its location, and introducing systematic and thorough methods in its work. There is no better way in which a portion of the "net gains" of such an expedition can be applied than in perfecting an organization that will make similar expeditions unnecessary in future. It is not to be expected that the time and continued effort necessary to adequate supervision of such matters can be given by officers who have a number of other and more important duties which are constantly demanding their attention.

G. G. YEOMANS.

ONE OF THE WORLD'S HIGH RAILWAYS.—The Southern Railway of Peru crosses the Andes at an elevation of 14,666 ft. above sea level.

Milwaukee Yard and Engine Terminal at Perry, Ia.

New Facilities at an Important Division Point Built During the Reconstruction of 275 Miles of Line

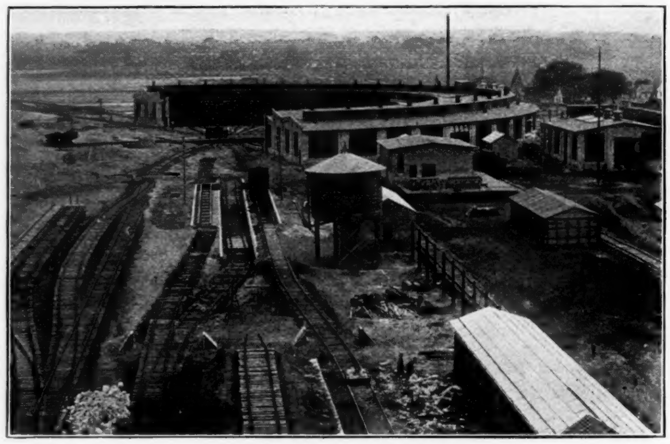
The traffic conditions which made advisable the reconstruction of 275 miles of the Chicago, Milwaukee & St. Paul main line in Iowa, and the general features of this work, which has been practically completed in the last two seasons, were described in the *Railway Age Gazette,* of March 20 and May 8. The line on which this improvement was made includes three engine districts, with intermediate terminals at Marion and Perry. In connection with this improvement, a new yard and complete terminal facilities were built at Perry, containing a total of about 28 miles of track, and costing approximately $1,000,000, including improvements that have been planned, but are not yet under construction. The work on this terminal was begun in September, 1912, and was pushed so rapidly that the roundhouse was ready to receive locomotives in March, 1913.

The old terminal was located east of the town, and was not large enough to handle efficiently the engines which turn there. As it proved too difficult to secure land for the enlargement of this terminal adjacent to the old layout, an entirely new location was adopted west of Perry, and the old plant will be abandoned. The new terminal begins at the crossing of the Minneapolis & St. Louis about 1,600 ft. west of the station, and extends to the Coon river, a distance of about two miles. The classification yards are located on opposite sides of the two main tracks, and the engine terminal is located north of the yards at a distance sufficient to provide room for future expansion of both the yards and the terminal.

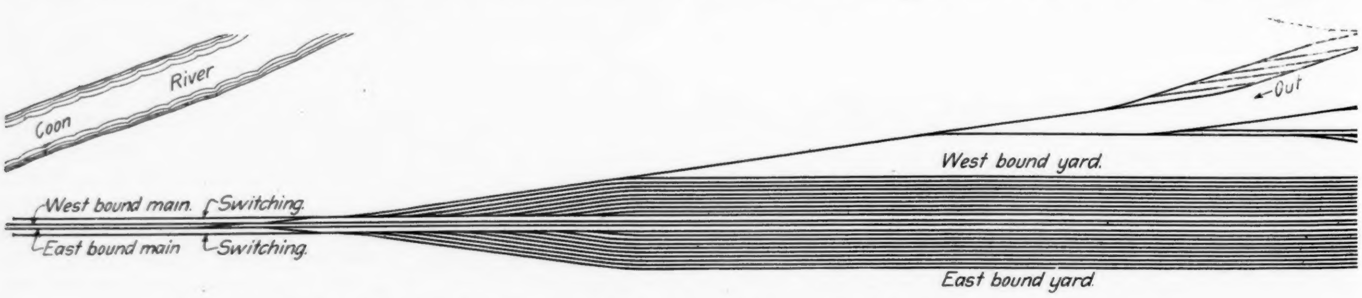
The grading for the yard was handled by contract, but the construction of the buildings, with the exception of the brick work, was done by company forces. The grade through the yard was fixed at 0.4 per cent. The contractors handled about 500,000 yd. of material for the terminal, two Bucyrus shovels, one 70-ton and one 45-ton, and a team outfit of about 300 teams being used for this work. Seven elevating graders, one of which was operated with a gasolene traction engine, were used in loading wagons. This team outfit handled a maximum yardage of 110,000 yd. per month. The contractors employed about 250 men on the terminal, 30 of whom were brick layers, and the company force totaled 300 to 600 men, including the track gangs. A general foreman was in charge of all the company forces, with about 15 to 25 foremen covering the various classes of work. Four material clerks, three timekeepers and two complete instrument corps were kept on the ground.

All passenger and freight engines change at Perry, making it necessary to design the terminal for about 60 engines a day, with provision for taking care of 75 if necessary. The heaviest locomotive in use weighs about 140 tons in working order. Heavy running repairs are made at this terminal. All engines will enter the house from the east side, two inbound leads being provided, one of which extends to the passenger station for the use of passenger locomotives. Eastbound freight engines leaving their trains in the eastbound yard will take a running track south of the main tracks to a set of crossovers just west of the Minneapolis & St. Louis crossing, and will reverse through these crossovers to one of the leads entering the terminal. After leaving their trains in the yard, westbound freight engines will pull through to the west end of the yard, and return on a running track, passing between the yard and the engine terminal, to an intersection with the inbound leads, where they will reverse to enter the house. Outbound freight engines can leave the house either to the east or to the west, according to the direction of their run.

The yard is terraced, the round house being about nine ft. above the elevation of the classification tracks, and the average cross grade being about 0.7 per cent. Each of the classification yards consists of 10 tracks about 4,000 ft. long, with a provision for adding five on each side whenever the traffic requires. The yard is laid with 75-lb. rail, and the engine leads with 85-lb. rail. Oak ties have been used on all curves, with cedar ties on the tangents. Six in. of gravel ballast is placed under yard tracks, and 12 in. under the main line. No. 10 frogs are used on a lead with an angle of 7 deg. 57 min. Cross drainage in the engine yard is provided by laying lines of six-in. unglazed tile with open joints at 200-ft. intervals, these lines being covered with crushed stone. This drainage is carried to Coon river in a main outfall sewer 18 in. in diameter.



General View of the Roundhouse

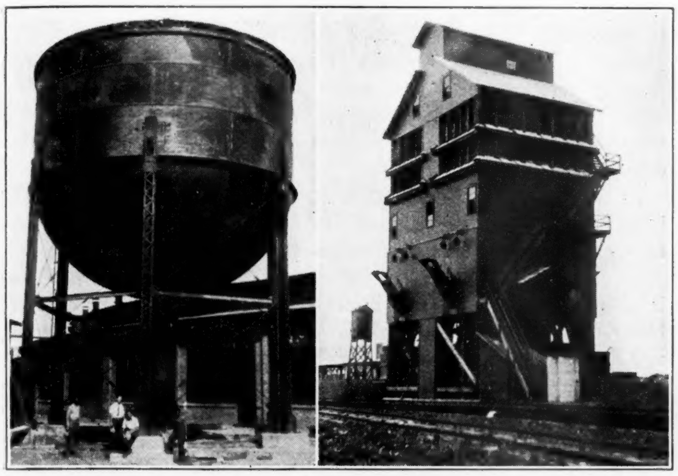


Layout of Division Yard and Engine Terminal of the Chicago, Milwaukee and St. Paul at Perry, Ia.

The terminal includes a 30-stall round house with provision in the heating and water pipe systems for an addition of 21 stalls, a power house, machine shop, storehouse, car repair shed, coaling station, clinker pit, oil house, sand house, ice houses, and a number of minor buildings. The auxiliary yards include two 1,300 ft. tracks for cabooses, two coach tracks, two 1,200-ft. coal storage tracks, two car repair tracks, a wrecker track, and the

necessary service and supply tracks. A 40-ft. track scale of 150 tons' capacity is provided in the classification yard.

The engine house is of brick construction, with a gravel and composition roof. The radius of the inner circle is 129 ft. 3½ in., and the building has a depth of 96 ft. from the inner posts to the back wall. It is divided into two sections of 15 stalls each by a brick firewall with steel clad doors. The pits are 81 ft. long, draining to the inner end. The house is heated by a hot air system, the air being dried over steam coils, and circulated by a three-quarter housed bottom horizontal discharge plate fan, with a capacity of 90,000 cu. ft. of air per minute, located in a fan-house alongside the engine house. To secure a permanent and serviceable supply line, the heating ducts were made of reinforced concrete, and placed under ground. The main duct from the fan-house divides into two parts as it enters the roundhouse proper, and is carried around the house just back of the end of the engine pits. Laterals were laid between each pair of pits connecting to 18-in. openings at the end and side of each pit to secure circulation of the warm air.



The Steel Water Tank and Coaling Station

The pit rails are laid directly on the concrete, and are held in place by clips over bolts set in the pit walls. Four drop pits are provided to handle the necessary truck repairs. The smoke jacks are of asbestos and cast iron. Two types of cast iron jacks are used, the ones over the drop pits being stationary, and the others having a vertical adjustment to adapt them to the engine using that stall. The house is paved with brick between the pits, solid doors are used on the inner circle, and ample window area amounting to about one-fifth of the surface of the building is provided.

The boiler washing pipe is placed in a reinforced concrete duct just under ground against the rear wall of the house. The blow-off pipe line is located in a similar duct which connects the front end of the engine pits. Four special pits are provided, a driver removal pit, engine truck wheel removal pit, tender truck wheel removal pit, and an engine truck drop pit.

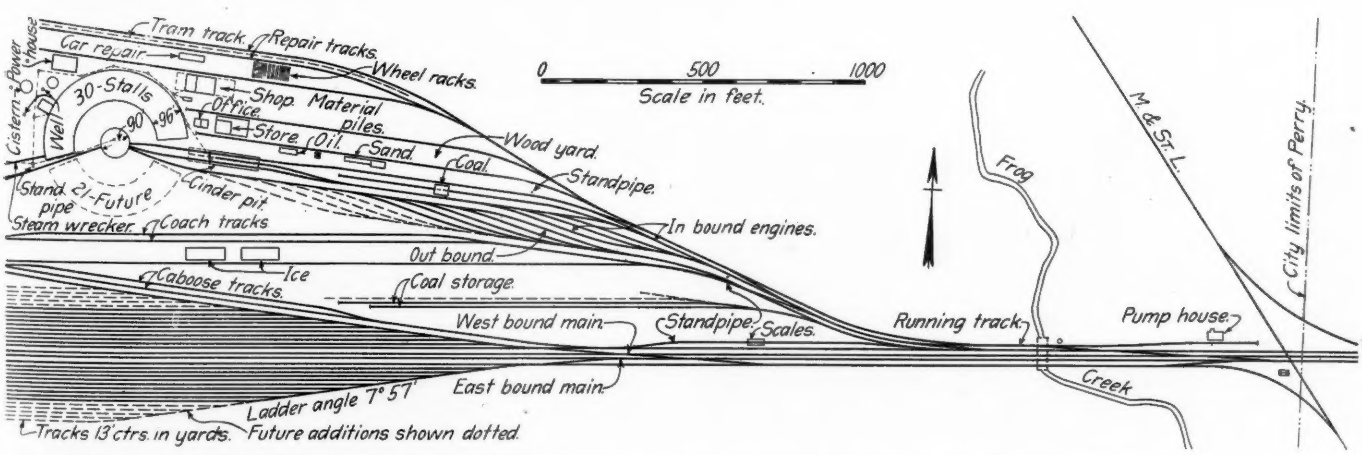
Every third pit receives the drainage from the two adjacent pits, and then drains directly into one of the catch basins in front of the house. The downspouts from the roof empty into the engine pits. Each of the special pits has a direct drain into a catch basin. To eliminate any possibility of the steam wrecker being tied up in the house due to an accident to the turntable, provision is made for its entry into the last stall at the rear of the house. The building is lighted by electricity, 100 c. p. tungsten lights being installed in two-light clusters between each pair of stalls.

The turntable is 90 ft. in diameter, operated by an electric tractor. Wires carrying current to this tractor are strung overhead to a pipe conduit extending up from each side of the table and connected at a height which clears an engine using the table.

The power house is a brick building on concrete footings with a framed roof covered with a gravel and composition surface. Three boilers are installed, and provision is made for two more. The engine room contains two steam pumps, a direct-connected generator and an air compressor. The generator has a capacity of 100 k. w., and generates 220-volt d. c. current. The compressor is a Laidlow-Dunn-Gordon machine, with a capacity of 1,000 ft. per minute.

The machine shop is of the same construction as the power house, and is divided into a blacksmith and machine shop. It is equipped with all the necessary apparatus for making ordinary repairs, including a 1,600-lb. drop hammer. All of the buildings are heated by steam—direct radiation—except the round house.

The coaling station is of the endless bucket conveyor type, with a storage capacity of 440 tons, and a hoisting capacity of 440 tons in 12 hours. The hoist is electrically operated, the current being secured from the power house. The house is arranged to supply coal to engines on two tracks, and a track arranged for gravity feed is provided for the coal cars. There are seven storage pockets, one of 200 tons' capacity, two of 100 tons and four of 12 tons. Each of the 12-ton pockets is equipped with a Fairbanks scale outfit for weighing all engine coal. The small pockets are filled from the large ones.

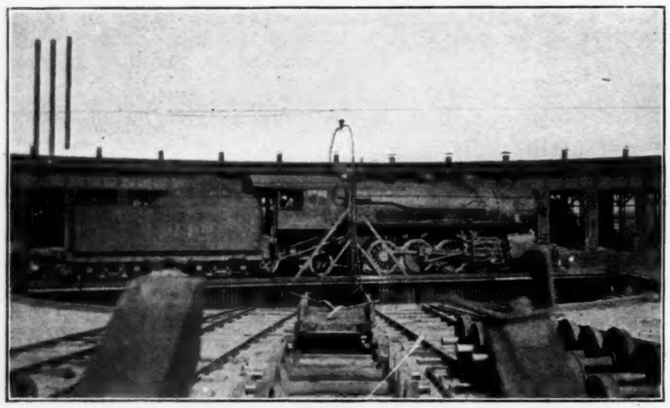


Layout of Division Yard and Engine Terminal of the Chicago, Milwaukee and St. Paul at Perry, Ia.

A separate sand house is located adjacent to the incoming engine tracks, including a room for wet sand storage, and a dryer room. The sand is dried in a long cylinder, which is bricked in and heated by two fires under the kiln-like structure. The dry sand is elevated to the sand towers by compressed air, two of these towers being provided to serve two tracks.

The water supply for the terminal is secured from five wells about 140 ft. deep, from which about 420,000 gal. is pumped

daily. Two Downey and one air lift deep well pumps, with a capacity of about 200 gal. per min. each, are now in service, and two more of the former type will be installed later. Storage is secured in a 600,000-gal. surface reservoir and a 150,000-gal. elevated steel tank. For fire protection the well pumps can feed direct into the surface reservoir or elevated tank, and the steam pumps in the power house can be used to draw on the reserve supply and elevated tank. The main fire line is a 12-in. pipe. About one mile of cast iron water main has been laid, including the service and fire lines. The service lines serve



The 90-ft. Turntable Showing Method of Bringing in Operating Wires

four penstocks located along the engine tracks. Hose and sprinklers are provided at numerous points about the buildings.

The clinker pit is located under two tracks, and is long enough to allow three engines to dump on each track. The pit is brick paved; the tracks being supported by cast iron pedestals and steel girders. The clinkers are loaded by hand into a car running on a depressed track between the two dumping tracks. The clinker pit and the other buildings in the terminal are drained to a sewer running around the outside of the engine terminal to the outfall sewer mentioned above.

The storehouse is a brick building 50 ft. x 40 ft., with a platform 100 ft. x 50 ft. The oil house is also a brick building 54 ft. x 16 ft., with a corrugated iron roof and a concrete floor,

A Portion of the Yard at Perry

making it fireproof throughout. The oil is stored in five large tanks, which are elevated on concrete platforms. One unusual feature in the operation of this terminal is the use of corncobs for engine fuel. A cob-house is located adjacent to the oil house, and in firing up an engine, a hostler takes a large can of cobs from this cob-house, oils them in the oil house, and takes them into the round house to start the fire. An ice house 120 ft. x 38 ft., with a capacity of 1,600 tons, has been built, and another one of similar capacity is planned.

This improvement was handled under the direction of C. F. Loweth, chief engineer, and A. G. Holt, assistant chief engineer. G. S. Stayman was the assistant engineer on the district which included the Perry terminal, and H. W. Kueffner was the resident engineer in direct charge of the work.

ECONOMIES OF THE BIG HOLE METHOD OF BLASTING

The advantages of using larger and deeper blast holes in excavating hardpan, shale, limestone, sandstone, etc., have in many instances not been appreciated as generally as their importance warrants. By the use of deeper holes the tendency to "blow out" is practically eliminated, effecting a saving in the cost of explosives and as the deeper and larger holes permit a much greater spacing between the holes, fewer drills and drill operators are required. The cost of springing is also eliminated by this method as the large holes contain enough explosive for a successful shot.

In making a cut of 40 or 45 ft. by the old method of small hole drilling, the material must be removed in benches, necessitating relaying the steam shovel track three times in making the cut. In order to keep enough material ahead of the shovel, it is also necessary with this method to stop work to shoot off a blast, requiring the construction of a mat to protect the shovel, and involving a loss of time to the entire crew. Cuts of this depth can be taken out by the big hole method, drilling directly from the surface to the roadbed level, and making a single pass with the shovel. As shots can be set off at noon or in the evening which will break up enough material ahead of the shovel to keep it supplied for several days, no time need be lost on this account.

As an example of the results that can be obtained by the big hole method, the following record which was made in the construction of the Western Maryland extension to Connellsville is presented. This work was handled by the J. B. Carter Company, W. M. Douglas being the superintendent in charge. The data given was furnished by J. V. Lewis, of the Cyclone Drill Company, Orrville, Ohio. In 30 days, 37,100 cu. yd. of rock were moved. For the first 15 days the shovel was working in a hard sandstone ledge about 12 ft. thick, during which time 16,000 cu. yd. were moved. During the latter 15 days the shovel was in black shale, moving 21,100 cu. yd. There was an average loss of one hour per day during the month for shifting track on the dump. The total number of cars loaded for the 30 days was 12,443. The largest day's run was 836 cars, the average day being 415. The average yardage handled per car was 2.98 cu. yd. The cost of moving the 37,100 cu. yd. was as follows:

	Total cost	Cost per cu. yd.
Total expense of the shovel, including superintendent, foreman, crew and laborers	$3,623.00	$0.0975
Cost of explosives	302.00	0.0075
Cost of trestle	229.00	0.0050
Cost of coal	235.00	0.0075
Cost of oil and waste	32.00	0.0015
Cost of water	112.00	0.0033
Cost of interest on plant	110.00	0.0033
Cost of depreciation	460.00	0.0125
Total	$5,103.00	$0.1381

The equipment consisted of one 70-ton Bucyrus shovel, two 16-ton Vulcan dinkey engines, 24, 4-cu. yd. Western dump cars, 54 tons of 60-lb. rail and one Cyclone railroad contractor drill, of the smallest size. Thirteen other Cyclone drills were used for big hole blasting on other sections of this work. In drilling hardpan, shale, sandstone, etc., 3 in. holes are used, but in limestone and similar hard material where dynamite is used, 5⅝ in. holes are required.

Railways for Portuguese Colonies.—The Portuguese minister for the colonies will shortly lay before the Chamber of Deputies a scheme for a considerable extension of the railways already begun in Angola and a joining up of the lines with the railway systems of contiguous foreign colonies.

A Practical Method for the Adjustment of Curves*

Describing the Use of a String Instead of a Transit in Relining, Also Determination of Super-Elevation

By W. F. Rench,
Supervisor, Pennsylvania Railroad, Tacony, Pa.

The rules for track maintenance of some roads require that the alinement of curves shall be maintained by the string method. While this is intended to apply more particularly to the small corrections which may be called detail lining, the method is even more useful for restoring the general line and in this respect is superior to the transit instrument. The general relining of curves is an engineering problem and outside the domain of the track foreman. Indeed, it is recommended that foremen be enjoined from using the string except for detail lining or to obtain data for a study of the curve by the supervisor.

This method of curve adjustment is based upon the geometrical proposition that the shifting of one point results in a change of one-half the amount in the ordinates of the two adjoining points. While this is not strictly correct, it is sufficiently so for all practical purposes. The change is, of course, slightly less than one-half, but the error is negligible even for the sharpest curve or the longest string. The exact geometrical relation is shown in Fig. 1.

There is another method in use which employs this principle, but the solution is a series of approximations and is a very laborious one. It is also considered impractical of application to the sharper curves. The method herein developed is a simple mathematical computation which is rendered quite facile by the aid of an important corollary that has been deduced. It is applicable alike to the sharpest or the lightest curve.

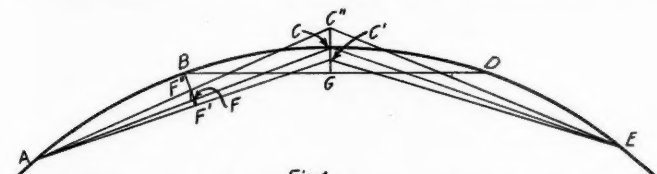


Fig. 1.

CC' and CC" = inward and outward throw. CG and BF = middle ordinates. FF' and FF" = half functions of CC' and CC". BF' and BF" = resultants.

Sketch Showing Effect of Throwing Track at One Point Upon Adjacent Points

THE PRELIMINARY TEST

The length of the string may vary between 62 ft. for a 4 deg. curve and 100 ft. for a 30 min. curve, but it is sometimes useful to fix the length so that a station will occur at each full elevation point.

In the event that the preliminary test of the curve develops a difference between the greatest and the least ordinate in excess of the mean ordinate it is preferable to obtain new data with a longer string, for while the method is applicable, the solution becomes somewhat tedious. It is also recommended that a very deficient alinement be first adjusted by the eye as far as possible before the test ordinates are taken.

It is essential that the ordinates be taken with great care and that they be accurate within ⅛ in. Nothing is gained by dividing below this figure, and indeed when applying the half functions in the solution it is quite proper to use the ⅛ above or below as best suits the case. Equal length of chords should be assured by establishing points with the tape line, these being consecutively numbered for future use. The stations should extend as far on the ends as any curvature exists, as it is quite important to have proper easements.

THE SOLUTION

The ordinates having been obtained the next step is the solution. The determination of the right treatment of a curve, or what may be called the *diagnosis,* is really the most important part of the proceeding. As a general proposition for an assemblage of ordinates wherein the first and last are below and the middle above the mean, the throw is inward; and where the first and last are above and the middle below, the throw is outward, although cases will arise where a combination of inward and outward throw is necessary.

It is well to observe particularly whether the ordinates at the two ends of a selected group are somewhat evenly balanced. If not, an adjacent throw is necessary to render them so before they can be considered as forming a practical series.

No exact relation exists between error and correction, but it will be found that *the throw at the middle of a series is approximately equal to the sum of the errors both above and below the mean of the series or to twice the sum either of the errors above or those below the mean.* If the sum of all the error is employed the working mean may be used, if double the sum of the errors one side or the other exact mean must be used. This rule is of practically exact application when the number of members in a series is odd. When even, the throw will be slightly more at the point next to the middle in the half requiring the greater correction and in the other half slightly less.

After applying the computed correction to the middle, the solution should progress toward each end in turn, keeping in mind, first, that the sum of the throws at the two points on either side of the middle must be such as to render the final resultant at the middle equal to the adopted mean and then, that each succeeding throw must be such as to make the resultant nearer the middle equal to this mean and, finally, that the resultant two stations from either end of the series much approximate the end ordinate so that the final throw will render both correct. The applied inward throw or half function of the outward throw may exceed the ordinate or resultant, in which event a minus value is assigned.

In the course of the solution due regard must be had for the easements of the curve. A very satisfactory spiral is obtained by diminishing the full ordinate a certain number of units for the ordinate at the first station off the body of the curve and one less unit for the ordinate at each successive station in turn. The maximum number of units will depend upon the amount of superelevation and its rate of decrease and should be one less than the number of stations in the run-off. The example given below is from an actual case (analyzed farther on) and is for a 3 deg. curve and 100 ft. chords. The maximum number of units is seven and each has a value of 9/32 in., giving ordinates as follows: 8, 6, 4¼, 2⅞, 1⅝, ⅞ and ¼. An example is also given of a spiral between the two parts of a compound curve, taken from the same case in which a 3 deg. curve is joined to a 1 deg. 50 min. curve, with resulting ordinates of: 7⅞, 6¼, 5⅜ and 4¾. In this case the maximum number of units is three and the value of the unit 9/16 in.

The worst possible error, and a not uncommon one, is to make the ordinates in the easement decrease at a uniform rate. This practice is responsible for the ill effects noticeable at the ends of curves that are otherwise perfectly alined and excellently maintained. The ordinates in the above case thus designed would be as follows: 7⅞, 6¾, 5⅝, 4½, 3⅜, 2¼, 1⅛, 0. A comparison of these figures with the true spiral shows the fallacy of this

*Copyrighted by W. F. Rench, May 15, 1914.

practice. A little farther on the one-eighth spiral is fully described as forming a good basis for the design of all spirals.

The string is indispensable for lining the curves of turnouts. It may not be generally known that for all turnouts from straight track regardless of the frog number if the adopted practical leads are used the ordinate at the middle of the string drawn between the heel of the switch and the toe of the frog is 6 in. and those at the quarter points 4½ in., and that for turnouts from the inside of a curve the middle ordinate is equal to 6 in. plus the ordinate of the main track curve, obtained with the same length of string as used for the particular turnout, and for turnouts from the outside to 6 in. minus such ordinate, the quarter ordinates in both cases being computed as three-fourths of the resulting middle ordinate.

The following examples illustrate the rudimentary principles involved in the string lining of curves and further examples are given in all of which the various processes of their solution are fully described. A final example is given in which all the features of curve adjustment are illustrated.

The throw is distinguished by a circle inclosing it; an arrow indicates the direction of the throw (to the left for inward throw and to the right for outward throw), and a letter when used indicates the sequence of the process.

Examples 1 to 4 are elementary and the successive steps will

Example 1.

Station.	Ordinate.	Solution.
1	1½	1¾
2	1¾	2¼ ← ½ b 1¾
3	2¼	← 1 a 1¼ 1½ 1¾
4	1¾	2¼ ← ½ c 1¾
5	1½	1¾

Example 2.

Station.	Ordinate.	Solution.
6	2	1¾
7	1¾	1¼ b ½ → 1¾
8	1¼	a 1 → 2¼ 2 1¾
9	1¾	1¼ c ½ → 1¾
10	2	1¾

Example 3.

Station.	Ordinate.	Solution.
11	2	1¾
12	1½	1¼ b ½ → 1¾
13	1½	a ½ → 2 1¾
14	1¾	1½ 1¾
15	1¾	2¼ ← ½ d 1¾
16	2¼	← 1 c 1¼ 1½ 1¾
17	1¾	2¼ ← ½ e 1¾
18	1½	1¾

Example 4.

Station.	Ordinate.	Solution.
19	1½	1¾
20	2	2¼ ← ½ b 1¾
21	2	← ½ a 1½ 1¾
22	1¾	2 1¾
23	1¾	1¼ d ½ → 1¾
24	1¼	c 1 → 2¼ 2 1¾
25	1¾	1¼ e ½ → 1¾
26	2	1¾

Example 5. (0°45' curve with 100' string.)

Sta.	Ord.	Solution.	Sta.	Ord.	Solution.	Sta.	Ord.	Solution.
1	0	⅛	12	2⅜	← 1¼ 1½ 1½ 2	23	1⅞	1¼ ⅞ → 2⅛ 2
2	⅜	← ⅜ 0 ¼	13	2	2⅝ ← 1 1⅝ 2	24	2⅛	1⅝ ⅜ → 2
3	⅞	1⅛ ← ⅜ ½	14	2	2½ ← ⅝ 1⅞ 2	25	2¼	2
4	⅞	1¼ ⅞	15	1⅞	2¼ ← ¼ 2	26	1¾	2
5	1⅛	⅜ → 1¼ 1⅜	16	1⅞	2	27	2⅜	← ⅝ 1¾ 2
6	1⅛	1⅜ ⅜ → 2	17	2¼	2	28	1¾	2 ← ⅜ 1⅝
7	2⅛	2	18	2⅛	1⅝ ⅜ → 2	29	⅞	1¼ ⅞
8	1¾	2	19	2	1⅝ ⅞ → 2¼ 2	30	½	⅜ → ¼ ½
9	2⅛	2⅜ ← ⅜ 2	20	1⅞	1⅛ 1¼ → 2⅜ 2	31	¼	⅛ ⅛ → ¼
10	1⅞	2¼ ← ⅜ 1⅞ 2	21	1¾	1½ → 3¼ 2⅝ 2	32	¼	⅛
11	2⅛	2¾ ← ⅞ 1⅞ 2	22	1⅞	1⅛ 1¼ → 2⅜ 2			

Simple Solutions of String-Lining Problems

be minutely described in order that every detail of the solution may be fully understood. It is presumed the diagram in Fig. 1 has been studied and the terms throw and resultant as used are entirely clear.

An inspection of the group of five ordinates in Examples 1 and 2 discloses that both form a perfect series in which the ordinates either side the middle are exactly balanced, and a simple calculation shows the mean of the ordinates to be 1¾ in.; but in Example 1 the end ordinates are less and the middle ordinate is greater than the mean and the indicated throw therefore inward, while in Example 2 the end ordinates are greater and the middle is less and the indicated throw therefore outward.

In Example 1, the errors are, in succession, ¼ in., 0, ½ in., 0, ¼ in., and their arithmetical sum is 1, which is the throw at the middle of the series. This inward throw at Sta. 3 *diminishes* the ordinate at that station to a resultant 1¼ in. and the effect of this inward throw is to *increase* the ordinates at Sta. 2 and Sta. 4 one-half the amount of this throw, or ½ in., and the resultants at those two points thus become 2¼ in.

The sum of the throws at Sta. 2 and Sta. 4 must equal twice the difference between the resultant at Sta. 3, 1¼ in., and the desired final ordinate, 1¾ in., and will therefore equal 1 in.; but as both halves of the series are symmetrical, the throws at Sta. 2 and Sta. 4 will be equal and each ½ in. Applying the inward throw of ½ at Sta. 2 the resultant 2¼ in. is reduced to the desired mean and the ordinate at Sta. 1 is increased by one-half of ½ in., or ¼ in., bringing it to the desired mean and at the same time the first resultant at Sta. 3 is also increased by ¼ in. to a new resultant 1½ in. It will now be noted that this resultant equals the last ordinate in the series, as should be the case, and the final inward throw of ½ at Sta. 4, which reduces the resultant at Sta. 4 to the desired mean, simultaneously increases the second resultant at Sta. 3 and the ordinate at Sta. 5 to the desired mean.

The processes in Example 2 are exactly similar except that the outward throws *increase* the successive ordinates and resultants, and the effect is to *decrease* the adjacent ordinates or resultants. It will be noted that the errors in Example 2 are also ¼, 0, ½, 0 and ¼ in., and the middle throw 1 in. as in Example 1.

Examples 3 and 4 illustrate the case where an adjacent throw is necessary to render the groups Sta. 14 to Sta. 18 and Sta. 22 to Sta. 26 each a practical series. As will readily be seen it only needs that the ordinate at Sta. 14 be reduced to 1½ in., and that at Sta. 22 increased to 2 in. to render both an evenly balanced series.

The half function of an outward throw of ½ at Sta. 13 and of an inward throw of ½ at Sta. 21 reduces the ordinate at Sta. 14 and increases the ordinate at Sta. 22 to the required resultants and incidentally renders the resultants at Sta. 13 and at Sta. 21 equal respectively to the ordinates at Sta. 11 and Sta. 19, so that a final outward throw of ½ at Sta. 12 and inward throw of ½ at Sta. 20 renders the first three resultants in each example equal to the desired mean.

After this process the remaining members in the two examples become identical with Examples 1 and 2 and their final solution is exactly similar.

If these four examples be now considered as combined into one problem it will be seen how important is the question of determining by the preliminary study of the curve the treatment to be accorded. The faculty of being able to do this quickly is rapidly acquired by practice.

Example 5 has been selected because it illustrates the making of a spiral for the ends and because it contains a typical sharp and flat place. The spiral for a curve whose ordinate is 2 may decrease by 5, 4, 3, 2 and 1 units of value ⅛ in. each with final figures as obtained, viz., 2, 1⅜, ⅞, ½, ¼ and ⅛ in.

The sharp place between Sta. 8 and Sta. 16 has a total of positive errors of ⅝ in., and the middle throw at Sta. 12 is therefore 1¼ in. The sum of the two throws at Sta. 11 and Sta. 13 must be 1⅞ in. to make the final resultant at Sta. 12 2 in., and the throw at Sta. 10 must be ⅜ in. to make the final resultant at Sta. 11 2 in. and the resultant at Sta. 10 nearly equal to the ordinate at Sta. 8. The sum of the two throws must be ⅝ in. at Sta. 14 to make the final resultant at Sta. 13 2 in. and the resultant at Sta. 14 equal to the ordinate at Sta. 16. A final throw of ⅜ in. at Sta. 9 and of ¼ in. at Sta. 15 completes the correction of the series.

The flat place between Sta. 17 and Sta. 25 has a total of positive errors of ¾ in. and the middle throw at Sta. 21 is therefore 1½ in. The sum of the two throws at Sta. 20 and Sta. 22 must be 2½ in. to make the final resultant at Sta. 21 2 in., and the throws at Sta. 19 and Sta. 23 must each be ⅞ in. to make the final resultants at Sta. 20 and Sta. 22 2 in., and to make the resultants at Sta. 19 and Sta. 23 equal or nearly equal to the ordinates at Sta. 17 and Sta. 25. A final throw of ⅜ in. at Sta. 18 and Sta. 24 completes the correction of the series.

The adjustment of the spirals involves only detail correction and does not follow any set rule. It is apparent there is a sharp place at Sta. 2 and Sta. 3 and at Sta. 27 and Sta. 28, and that there is similarly a flat place at Sta. 5 and Sta. 6 and at Sta. 30 and Sta. 31.

Example 6 has been selected for elaboration as requiring the application of all the above rules. A study of this curve shows: That the easement Sta. 1 to Sta. 3 is not a true spiral; that there is a very sharp place between Sta. 5 and Sta. 9; that both an outward throw on one side and an inward throw on the other will be necessary to eliminate this sharp place; that there is a flat place between Sta. 8 and Sta. 17; that there is a flat place between Sta. 18 and Sta. 25; that there is a sharp place between Sta. 28 and Sta. 33, and that the correction of the latter must also restore the spiral feature between Sta. 33 and 35.

The average for the body of the curve is 13/16 in., but in line with the adopted standard it will be proper to work to either 3/4 in. or 7/8 in. Evidently since Sta. 3 and Sta. 4 are less than the mean while Sta. 5, Sta. 6 and Sta. 7 are greater, two other stations below the mean are needed to complete the series. But Sta. 8 and Sta. 9 will also be a part of a series requiring outward throw. We must estimate for the time being the value of the resultants at Sta. 8 and Sta. 9 after the prospective outward throws at Sta. 9 and Sta. 10, which resultants we assume may become equal to the ordinates at Sta. 3 and Sta. 4. The average of this series is then 7/8 in. and, applying the corollary, the sum of the positive errors being 3/4 in., the correction at Sta. 6 is 1½ in. It is apparent that the sum of the throws at Sta. 5 and Sta. 7 must be 2¼ in., and that the use of 1 in. at Sta. 5 and 1¼ in. at Sta. 7 will render the resultant at these two points equal to the ordinate at Sta. 3 and the resultant at Sta. 9 respectively, and that the completed solution will attain the desired average.

Example 6.

Sta.	Ord.	Solution.				Sta.	Ord.	Solution.				Sta.	Ord.	Solution.			
1	1/8					13	3/4	2 3/4	3 1/2	2 1/8	3/4	25	1 1/4	7/8			
2	3/8	1/8	3/8			14	1/2	-7/8	2 5/8	1 3/4	3/4	26	3/4				
3	3/4	7/8				15	3/4	-1/2	1 3/8	1 3/8	3/4	27	7/8				
4	5/8	1 1/8	1/4	7/8		16	1/2	-1/8	1 3/8	1	3/4	28	3/4	7/8			
5	1	1 3/8	1	3/4	7/8	17	1	3/8	3/8	3/4		29	3/4	1 1/8	3/8	7/8	
6	1 1/4	1 1/2	-1/4	1/4	7/8	18	1	7/8	3/4			30	7/8	1 3/8	5/8	3/4	7/8
7	1 1/8	1 7/8	1 1/4	5/8	7/8	19	1	5/8	1/4	7/8		31	1 1/8	7/8	1/4	1/2	7/8
8	1 1/8	1 7/8	1/2	1 3/8	7/8	20	7/8	3/8	5/8	1	7/8	32	5/8	1 1/8	1/8	3/4	
9	1	1 1/4	0	7/8	7/8	21	1/2	-1/8	1 1/8	1	3/4	33	5/8	7/8			
10	3/8	-1	2 1/8	1 3/8	7/8	22	5/8	1 3/8	2	1 1/2	7/8	34	3/8				
11	5/8	-3/4	2 5/8	1 7/8	3/4	23	5/8	0	1 1/4	1 1/4	7/8	35	1/8				
12	1/2	-7/8	2 7/8	2	3/4	24	7/8	1/4	5/8	7/8							

A More Complicated Example

Noting that the resultants at Sta. 8 and Sta. 9 after the inward throw of ½ in. at Sta. 8 are 1⅜ in. and 1¼ in. we find that the mean of the series Sta. 8 to Sta. 18 is ¾ in., and that the sum of the positive errors is 1⅜ in., which indicates a throw of 2¾ in. at Sta. 13. The resultant at Sta. 13 is 3½ in., and the sum of the throws at Sta. 12 and Sta. 14 must be equal to 5½ in. in order to make the final resultant ¾ at Sta. 13.

As a greater throw is evidently necessary for the first half we try 2⅞ in. at Sta. 12 and 2⅝ in. at Sta. 14. It is now easy to follow to the end; the next throw must be 2⅝ in. to reduce the resultant at Sta. 12 to ¾ and the next 2⅛ in. to reduce the resultant at Sta. 11 to ¾ in. The resultant at Sta. 10 now approximates the resultant at Sta. 8, and a final throw of ⅞ in. at Sta. 9 renders the resultant at this station and also at Sta. 8 and Sta. 10 ⅞ in., and confirms the correctness of the resultants assumed for Sta. 8 and Sta. 9 in the beginning of the solution. We follow a similar method between Sta. 14 and Sta. 18, with the resultant for Sta. 16 approximating the ordinate at Sta. 18.

The series from Sta. 18 to Sta. 25, the average of which is ⅞ in. with the sum of positive errors of 11/16 in. and a maximum correction therefore of 1⅜ in., follows the general lines already described.

The elimination of the sharp place, Sta. 28 to Sta. 33, presents the case of a series with an even number of members. The computed maximum throw is ¾ in., but as the higher stations require greater correction, ⅞ in. is adopted for Sta. 31 and ⅝ in. for Sta. 30.

The resultant at Sta. 33 completes a practical spiral and a slight detail throw at Sta. 2 accomplishes the same result.

THE APPLICATION

When the curve corrections are obtained it only requires that the indicated throws be made. The string is not again required. The figures for the throw may even be telephoned the foreman with confidence that the result will be a correct alinement.

To record the original position of the track a pole is used, which should be of white pine planed on four sides and about 9 ft. long. It is placed against the web of the rail of the adjacent track and at right angles to the rail and the position of the gage line marked upon it. The number of the station is also applied for identification during the course of the lining. The pole record of the original position of the track may be preserved for a day or two to test the corrected line for slight defects that are liable to occur while the track is becoming bedded in its new position. If the throw has not been great this will not be necessary. Sometimes stakes are planted a uniform distance from the rail, but this involves considerable labor, and they have no advantage in any other respect over the pole method, except for single track, when stakes are necessary.

In special cases, such as spike lining through switches or crossings, it is convenient to mark the original position of the rail directly upon a tie from which the spikes have been withdrawn. On such lining the rule that quarter ordinates are three-fourths the middle ordinate can be employed with advantage.

It will be surprising to note the great saving in time and expense that will result from this method of lining curves. Not one pull with the bars will be made without a purpose. The lining is positive and the result is not only certain but expeditious. The method is quite interesting and the correction of his curves becomes not work but play to the supervisor.

RUN-OFF OF CURVES

After the curve has been relined and defective easements corrected it may be necessary to resurface the run-off, as the full elevation, both from theoretical considerations and as a matter of experience, should obtain at the station on the body of the curve *next* to the last point of full ordinate, and not at the latter point, provided the stations are not less than 30 ft. nor more than 50 ft. apart. This is of course by reason of the physical principle that the car travels as a single body and the centrifugal force does not reach its maximum effect until the car is wholly upon the curve.

The approach and run-off of curves in high speed tracks should be co-ordinated with the curve of the easement so that the rate of increase or decrease of elevation may be uniform and not greater than 1½ in. to 100 ft. The preferable rate is 1 in. to 100 ft., but for light curves ¾ in. to 100 ft. is quite satisfactory.

Where easements are lacking and a short run-off must be used and the speed is limited, say to 45 miles per hour, a practical run-off is obtained by making the elevation at the point of curve one-half the full elevation which will then obtain 30 ft. to 50 ft. beyond the point of curve, while the point of no elevation obtains 30 ft. to 50 ft. back of the point of curve. The elevation at the middle point back of the point of curve should be slightly less than one-fourth the full elevation and that beyond the point of curve slightly more than three-fourths the full elevation, which will make the profile of the elevated rail a vertical reverse curve and render the run-off quite as easy for moderate speed as the longer run-off is for high speed. An example of a short run-off for a 2 deg. curve with 1½ in. elevation, to be operated at 45 miles per hour, is as follows: 0, level; 0 + 20, ¼ in., 0 + 40 (P. C.), ¾ in.; 0 + 60, ¼ in.; 0 + 80, 1½ in. The short run-off should not be used for sharper curves than 3 deg. unless the speed is so restricted that the necessary amount of superelevation will admit of the approach or run-off being made at a rate not greater than 1½ in. to 40 ft.

SUPERELEVATION OF CURVES

The maintaining of line on curves is directly related to the selection of proper superelevation both for the body of the curve.

and for the easements. It is not possible to make a formula that will apply alike to all variations of curvature, for any such formula would apply only to the ideal curve. The ideal curve is the one of greatest radius wherein the slight errors due to shifting under traffic are of minimum effect. This curve for high speed main lines is about 0 deg. 45 min. The distortion of a curve through this traffic shifting is proportionately greater as the degree of curve diminishes. Since superelevation should be adjusted to the curvature that exists, manifestly a curve should have the superelevation that would attach to the highest degree actually obtaining rather than that which would apply to the assumed degree of the curve. Similarly, as curves sharper than the ideal suffer relatively less distortion under traffic and also because of the destructive effects from the slower traffic when the superelevation is excessive for such movement, and especially from theoretical considerations outlined in the next paragraph, less elevation is proper for such curves than the theoretical formula would indicate.

As the centrifugal force acts horizontally and the component of this force along the plane of the top of the rails diminishes as the degree of curve (and with it the superelevation) increases, and as, by the fact of the car body being pivoted on supports near its ends, its center of gravity is deflected inward, which deflection increases as the degree of curve increases, the component of the centripetal force developed by the weight of the car increases with the degree of curve, and there is, therefore, by theory as well as experience, less superelevation necessary for equilibrium as the degree increases.

An empirical rule has been found which satisfies the requirements referred to and which has been amply tested in practice. Its usefulness depends upon the employment of the actual measured degree and not the sometimes incorrectly recorded degree and presumes maintenance with reasonable fidelity.

Write a series of arcs between 0 deg. 15 min. and 2 deg. in which the members increase progressively, the first increment being 5 min. and each succeeding increment 5 min. greater than the preceding one. Opposite the smallest arc place the constant 10, which represents so many ten-thousandths, and in inverse order the numerals to 4, which applies to the largest arc in the series and to all curves above 2 deg. The proper superelevation in inches is obtained by multiplying together the square of the limiting speed in miles per hour for the degree of the curve and the constant that applies, the nearest half-inch being used in the final result.

The theoretical elevations in the appended table were obtained by the use for all the degrees of curvature of the constant 6.6, which is in rather common use and is standard on some roads, and the practical elevations were obtained by the use of the constants shown. The apparent variance in result for the higher degrees of curvature really does not obtain, because it is customary to assume a comparatively low speed in such cases. But clearly this practice is objectionable because it lacks uniformity. The empirical rule requires only that the limiting speed shall be employed, which will always be fixed by time-table rule.

While the maximum speed only was considered in the making of the table, it will be found that the empirical rule furnishes equally satisfactory results for all speeds.

TABLE OF SUPERELEVATIONS

Degree	Constant	Theo. elev.	Prac. elev.	Max. speed
15 min.	10	3/4 in.	1 in.	70 miles per hour
20 min.	9	1 in.	1 1/2 in.	70 miles per hour
30 min.	8	1 1/2 in.	2 in.	70 miles per hour
45 min.	7	2 1/2 in.	2 1/2 in.	70 miles per hour
1 deg. 05 min.	6	3 1/2 in.	3 in.	70 miles per hour
1 deg. 30 min.	5	5 in.	3 1/2 in.	70 miles per hour
2 deg. 00 min.	4	6 1/2 in.	4 in.	70 miles per hour
2 deg. 30 min.	4	7 1/2 in.	4 1/2 in.	68 miles per hour
3 deg. 00 min.	4	(8 1/2) in.	5 in.	65 miles per hour
3 deg. 30 min.	4	(9) in.	5 1/2 in.	63 miles per hour
4 deg. 00 min.	4	(10) in.	6 in.	61 miles per hour
4 deg. 30 min.	4	(10 3/4) in.	6 1/2 in.	60 miles per hour
5 deg. 00 min.	4	(11 1/2) in.	7 in.	59 miles per hour

ANALYSIS OF EXAMPLE 7

The example below is intended to show the application of all the above methods in practice. The tangent offsets have been computed for the mean of the curvature between each two stations as obtained from the respective middle ordinates of those stations. It will be seen that in both easements the several offsets are in the approximate ratio of the cube of successive numerals, between 1 and 7 for the longer easement and 1 and 5 for the shorter one. The curve of the easements is thus very nearly the cubic parabola.

A comparison of the computed elevations with those that would conform with a regular rate of increase confirms the correctness of the empirical rule for superelevation. It will be noted that the practical elevations are a mean of the computed elevations on either side, as is proper from due consideration of centrifugal force as applied to a moving railway car. The limiting speed for the curve should be 65 miles per hour, and this requires that the 3 deg. curve should have 5 in. elevation and the 1 deg. 50 min. curve 3 1/2 in.

Example 7

Station	Original Ordinate	Solution				Final Ord.	Degree	Av. Deg.	Tan. off.	Theo. Elev.	Actual Elev.
2	0	1/4				1/4	06'	03'	.047	1/8	5/8
2+50	1/2	1 1/4	←3/8	7/8		7/8	20'	13'	33	1 1/8	1 1/4
3	1 3/4	2 7/8	←1 3/8	1 1/2	1 5/8	1 5/8	38'	29'	1.23	2	1 7/8
3+50	4	←2 3/8	1 5/8	2 1/4	2 7/8	2 7/8	1°05'	52'	3.26	2 3/4	2 1/2
4	4 1/4	5 3/8	←1 3/8	4	4 1/4	4 1/4	1°37'	1°21'	6.80	3 1/4	3 1/8
4+50	5 1/4	6	←3/8	5 5/8	6	6	2°16'	1°56'	12.41	4	3 3/4
5	8	8 1/4	9	←3/8	8 1/8	8	3°00'	2°38'	20.89	5	4 3/8
5+50	8 3/4	←1 1/2	7 1/4	7 5/8	8 1/8	8	3°00'			5	5
6	8 1/4	9	←1 1/8	7 7/8	8 1/8	8	3°00'			5	5
6+50	8 1/4	8 3/4	←5/8	8 1/8	8	8	3°00'			5	5
7	8 1/4	8 5/8	←1/8	8 1/2	7 7/8	8	3°00'			5	4 1/2
7+50	4 3/4	4 7/8	1 3/8→	6 1/4		6 1/4	2°25'			4	4
8	6	5 3/8				5 3/8	2°03'			3 1/2	3 1/2
8+50	4 1/2	4 3/4				4 3/4	1°50'			3 1/2	3 1/2
9	4 1/2	5 1/4	←1/2	4 3/4		4 3/4	1°50'			3 1/2	3 1/2
9+50	5	6 1/4	←1 1/2	4 5/8	4 7/8	4 3/4	1°50'			3 1/2	3 1/2
10	5 1/4	6 1/2	←2 5/8	3 7/8	4 3/4	4 3/4	1°50'			3 1/2	3 1/2
10+50	4 1/2	5 7/8	←2 3/8	3 1/2	4 3/4	4 3/4	1°50'			3 1/2	3 1/2
11	5	6 1/8	←2 5/8	3 1/2	4 3/4	4 3/4	1°50'			3 1/2	3 1/2
11+50	4 1/2	5 1/2	←2 1/8	3 3/8	4 3/4	4 3/4	1°50'			3 1/2	3 1/2
12	5 1/4	←2 1/4	3 1/2	3 5/8	4 3/4	4 3/4	1°50'	1°30'	7.85	3 1/2	3
12+50	2 1/2	3 5/8	←7/8	2 3/4	3 1/8	3 1/8	1°12'	57'	3.49	2 1/2	2 3/4
13	2	2 1/2	←5/8	1 7/8		1 7/8	43'	32'	1.27	1 3/4	1 3/4
13+50	1/2	7/8				7/8	21'	13'	.33	3/4	1 1/4
14	1/4					1/4	06'	03'	.047	1/4	5/8

Solution of Problem Combining Lining and Elevation Corrections

The curve of the spiral on the approach between Sta. 2 and Sta. 4 + 50 increases in a regular progression by increments of 6 1/2 min. multiplied by the numerals between 1 and 7, and the corresponding ordinates increase regularly by increments of 9/32 in. multiplied by the same numerals. The curvature of the spiral between the two curves, Sta. 8 and Sta. 7 + 50, increases by increments of 1, 2 and 3 times 12 min. respectively, while the ordinates increase by 1, 2 and 3 times 9/16 in. approximately. The curvature of the spiral on the run-off between Sta. 14 and Sta. 12 + 50 increases by 1, 2, 3, 4 and 5 times 7 1/2 min., while the ordinates increase by 1, 2, 3, 4 and 5 times 5/16 in. These rates of change in curvature co-ordinate satisfactorily with the rates of change in superelevation which are 1 1/4 in. to 100 ft. on the ends, and 1 in. to 100 ft. between the curves.

It will be noted in this example that the corollary which supplies the relation of error to correction is equally applicable to the easements, the only difference being that instead of a mean ordinate being use, the proper final ordinates at the respective stations are used.

The average error of this example before treatment was 12 per cent., which would not be bad but for the fact that two thirds of this error occurs at three points, which it is interesting to note are in each case within the easement. Sta. 3 + 50 and Sta. 7 + 50 are especially bad, and the easement Sta. 12 + 50 to Sta. 14 is generally deficient.

THE SPIRAL BY MIDDLE ORDINATES

As the string method of lining the body of curves has replaced the instrumental method, so also will the string method be found preferable for establishing the spiral at the ends of curves or between the parts of a compound curve. The spiral, which is indispensable when a new railroad has settled and be-

come fit for operation at high speed, is a refinement which is rarely provided in the original construction, and it must be obtained in the course of maintenance by readjustment to some extent of the body of the curve.

The prime requisite in the design of a spiral is that it shall be co-ordinate with the run-off of the curve, which in turn is dependent upon the amount of superelevation and its rate of decrease. This rate, generally stated before, may be established for high speed service somewhat as follows: for curves under 0 deg. 45 min., ¼ in. in 33 ft.; between 0 deg. 45 min. and 3 deg. ⅓ in. in 33 ft.; over 3 deg. 0 min., ½ in. in 33 ft. While it is not always possible especially for the sharper curves to obtain the exact spiral desired, there are certain principles which should be satisfied as far as possible. The important part of a spiral is the portion which connects with the circular arc or, in case of a compound curve, with the sharper curve.

The integrity of the spiral curve should be maintained through two-thirds of its length, or generally to the point where 1½ in. or less of superelevation obtains. Beyond that point the spiral admits of some modification and may be made more flat if desired or when necessary in order to extend it to the point of no elevation.

In example 7 it was shown that the spiral whose members increase by successive increments that are themselves in arithmetical progression is nearly of the form of the cubic parabola, which is recognized as the ideal easement. The simplest form in which this series of ordinates can be written is in terms of one-eighth, as follows: ⅛, ⅜, ¾, 1¼, 1⅞, 2⅝, 3½, 4½, 5⅝, 6⅞, 8¼, etc.

By proper selection of the length of chord the ordinate of the curve may be made to coincide with the member of this series which will furnish the desired or practicable length of easement. If for any reason it is necessary or desirable to use a different length of string than will provide this chord, it is only necessary to change the value of the unit to some multiple of ⅛, which is found by obtaining the ratio of the square of the chord which is used to the square of that which would be ideal.

A table has been prepared which gives the computed values of the functions pertaining to certain curves which can be extended by off-hand interpolations to include all curves. The question of superelevation and rate of decrease having been established for the known degree of curve, the proper length of chord may be selected from the table for use in making a study of the curve and for designing the easement. Or, conversely, the table may be used to determine the value of the unit when a different length of string is used.

Thus, in Example 7 a chord of 100 ft. was used for the 3 deg. portion of the compound curve as well as for the 1 deg. 50 min. portion, and the maximum number of units found practical for the desired easement of the 3 deg. curve was 7. By reference to the table it is found that the chord corresponding to a maximum of 7 units is 66 ft. The proper value of the unit is found by multiplying ⅛ by the ratio of $(100)^2$ to $(66)^2$, and it thus becomes 9/32.

As another illustration, a perfect spiral between a 3 deg. curve and a 0 deg. 20 min. curve would be obtained by the use of a 92 ft. string, when the ordinate of the sharper curve would be the 10th member of the series and of the flatter curve the 3rd member. The seven stations of easement, equivalent to nine stations of run-off, allow a decrease in elevation between the 5 in. for the 3 deg. curve and the 1½ in. for the 0 deg. 20 min. curve of ⅓ in. to 33 ft. But this easement might be unattainable and the rate of decrease need to be made the extreme limit for full speed, ½ in. to 33 ft. This would require that a 66 ft. string be used and the ordinate of the sharper curve would become the 7th member of the series and of the flatter curve the 2nd member, and the length of easement thus be reduced two stations. Any further reduction in the length of easement would require a reduction in speed.

While the design of the spiral is only indirectly related to the speed and similarly no arbitrary length of easement for certain groups of curvature is practicable, these functions have been added in the table for the convenience of those who may prefer to give them consideration.

Vertical Curves

The simplest method of computing a vertical curve is the orthodox one in which the correction at the grade intersection is one-half the difference between the elevation of the intersection and a mean of the elevations of the assumed tangent points, and the corrections at the other points are the fraction of the whole

Degree	Ordinate	Chord	Max. No. Units	Length easement equals superelevation times speed.	Rate of decrease in Run-off	Degree	Ordinate	Chord	Max. No. Units	Length easement equals superelevation times speed.	Rate of decrease in Run-off
0°20'	¾	93	3	93 = 1½ × 62	¼" in 33'	1°30'	1⅞	67	5	134 = 3½ × 40	½" in 33'
0°30'	1¼	100	4	150 = 2 × 75	"	2°00'	2⅝	70	6	175 = 4 × 45	"
0°45'	1⅞	98	5	196 = 2½ × 78	"	2°30'	3½	73	7	219 = 4½ × 49	"
1°05'	2⅝	96	6	240 = 3 × 80	⅓" in 33'	3°00'	4½	76	8	266 = 5 × 53	"
1°30'	3½	94	7	282 = 3½ × 80	"	3°30'	5⅝	78	9	312 = 5½ × 57	"
2°00'	4½	92	8	322 = 4 × 80	"	4°00'	6⅞	80	10	360 = 6 × 60	"
2°30'	5⅝	92	9	368 = 4½ × 82	"	4°30'	8¼	82	11	410 = 6½ × 63	"
3°00'	6⅞	92	10	414 = 5 × 83	"	2°00'	1⅞	60	5	120 = 4 × 30	⅝" in 33'
1°30'	2⅝	82	6	205 = 3½ × 59	⅖" in 33'	2°30'	2⅝	63	6	158 = 4½ × 35	"
2°00'	3½	82	7	246 = 4 × 62	"	3°00'	3½	66	7	198 = 5 × 40	"
2°30'	4½	83	8	290 = 4½ × 64	"	3°30'	4½	70	8	245 = 5½ × 45	¾" in 33'
3°00'	5⅝	84	9	336 = 5 × 67	"	4°00'	5⅝	73	9	296 = 6 × 50	9/16" " "
3°30'	6⅞	86	10	387 = 5½ × 70	"	4°30'	6⅞	77	10	385 = 6½ × 53	½" " "
4°00'	8¼	88	11	440 = 6 × 73	"	5°00'	8¼	80	11	400 = 7 × 57	7/16" " "

Table of Spiral Functions

correction represented by the square of their fractional distance from the tangent points, the corrections being minus for a summit and plus for a depression. The geometrical principles are illustrated in Fig. 2. The method is the more nearly exact the smaller the intersection angle of the grades; but this method is sufficiently accurate for all grades that are practical to railroads.

For vertical curves in high speed main lines the assumed tangent points should be so remote from the intersection that the correction 100 ft. from the tangent points will not exceed 3 in. It is desirable that where possible this correction shall be as little as 1 in. A too sudden change in analogous to a run-off that is made at an excessive rate.

Vertical curves are not employed in siding construction and

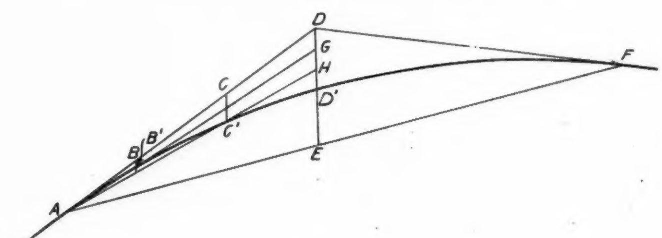


Fig.2.
E is a mean of A and F. D' is midway between D and E. DG = ⅓ of DD' and BB' = ⅓ of DG or ⅑ of DD'. DH = ⅔ of DD' and CC' = ⅔ of DH or 4/9 of DD'.

Geometrical Principles of a Vertical Curve

maintenance to the extent their usefulness deserves, and many derailments may be traced to lack of this feature. If the mean of the elevations of two points 18 ft. apart differs more than 1 in. from the elevation of the point midway between them a vertical curve is a necessity. The difficulty of introducing a vertical curve for a summit after the track is completed is of course appreciated. Vertical reverse curves or compound curves follow the same general lines as simple vertical curves. In the case of the former the best arrangement is had by entirely eliminating the tangent common to both.

CAREFUL SELECTION OF MEN FOR WORK TRAIN SERVICE*

By H. B. Hoyt

Assistant Supervisor of Track, New York Central & Hudson River, Rochester, N. Y.

The primary factor in efficient work train service is the attitude of the men on the train, considering both the crew and the laborers. The train crew should be ambitious and ready to take advantage of every minute they are allowed to work, particularly while working on the main track. While the work train is waiting for the use of tracks, the conductor should be making the necessary arrangements, the engineman should be ready to move instantly at a signal, and the flagman should be where he can protect the train so that no delay occurs in getting out on the main tracks. The conductor can also gain much time and can get more use of tracks when he secures the confidence of the despatcher and towermen by always doing exactly what he says he will and by clearing his train from the tracks at or before the time he has promised.

The laborers should be a selected lot of capable men in different lines, as, for example, the laborers on a track department work train should be capable of doing all kinds of track work so that they can be used to advantage in many ways while not on the train. In emergency cases, as at derailments, washouts, etc., these men are often the first on the ground, and they should be able to get to work immediately, clearing up after a wreck, putting in ties and rail, gaging, lining, ballasting, etc. Work train laborers should also understand that considering the fact that they are necessarily idle much of the time, as while riding from place to place or while the train is in the clear, more work is expected from them while they are actually at work than from regular track gangs. If necessary, it might be advisable to pay the laborers a little better than the average rate, so that a selected gang can be obtained and maintained. While a conductor is usually in charge of a permanent work train, the foreman and conductor should work together, as this will give the latter more opportunity to get better and more prompt train movements.

In case an extra or temporary work train is being handled, with continually varying crews and gangs, it should be personally managed by the supervisor, his assistant, or a general foreman who is familiar with the work to be done and has authority over all the men on the train. The crews and laborers on extra work trains are not usually familiar with the duties and if the train is handled by the supervisor or his assistant misunderstandings, danger and disputes will be minimized.

The number of laborers in a work train gang depends largely upon the class of work to be done. In a track department train a gang of twenty men is about as efficient as any number for ordinary work. This number of men will handle any material to be transferred; they can work on several cars at a time if desirable, or they can be divided into two gangs, each the size of a section gang, and in case of emergency they make a large enough gang to obtain quick results. In using section or track gangs for work train service, it is usually necessary to employ more men for a given amount of work, as they are not as familiar with the work nor do they take as much advantage of the many short intervals of time as a regular gang will. In addition there is always some delay in picking up a gang of this kind as well as returning the men to their headquarters when the day's work is done.

The equipment of a work train is also very important. The supply of tools for all kinds of work should be kept as complete as possible. On days when the steam derrick is not in use the derrick engineer should wash out the boiler and make any necessary repairs. When the train is on duty at headquarters arrangements should be hade to have all the tools put in repair and sharpened so that a full equipment is always on hand when on the road.

A work train should be given its instructions as far ahead as possible, for in many ways this facilitates and accelerates the work; also certain work should not be specified for certain days unless it is impossible to avoid this. On many roads the majority of the traffic is in one direction on certain days or at certain hours, or the traffic is light or heavy over the whole road at certain times. If the conductor keeps this in mind, and if he has several days' work ahead, he can arrange to use the tracks of lighter traffic, or to do work clear of main tracks and therefore increase the total work he can accomplish.

The efficiency of a work train depends after all on keeping it busy and training the men and crew to use each available minute, regardless of the kind of work on hand. Its use in cases of emergency, where its service is perhaps the most efficient, will counterbalance some of the times when the train may not be proving really economical for the time being.

*Received in the contest on The Proper Handling of Work Trains which closed December 27, 1913.

ABSTRACT OF ENGINEERING ARTICLES SINCE APRIL 17

The following articles of special interest to engineers and maintenance of way men, and to which readers of this section may wish to refer, have appeared in the *Railway Age Gazette* since April 17, 1914:

Construction of Milwaukee Avenue Viaduct.—The new reinforced concrete viaduct carrying Milwaukee avenue over the tracks of the Chicago, Milwaukee & St. Paul; the Chicago & North Western and the Pennsylvania Lines, recently completed by the C. M. & St. P., required the design and construction of through reinforced concrete girders which are thought to be the longest ever built and also required the use of special rail fastenings for the street railway lines crossing the structure in order to keep down the floor depth. The supporting bents are skewed, complicating the arrangement of the floor system. These and other details are described by J. H. Prior, formerly engineer of design, Chicago, Milwaukee & St. Paul, in the issue of April 24, page 947.

Why the Present Fiscal Year?—An editorial calling attention to the possibility of making important economies in railway operation by a change of the fiscal year to correspond with the calendar year, was published in the issue of April 24, page 931. This editorial emphasized particularly the inefficiency and extravagance of the present system of limiting maintenance expenditures during the spring months before the close of the fiscal year when there is the most to do in maintaining track and structures, when all labor expended in maintenance counts for the most, and when labor is the most plentiful. A second editorial on the fiscal year calling attention to the possible economies in the transportation department that would result from such a change, was published in the issue of May 1, page 974.

New Santa Fe Line Near San Bernardino, Cal.—The Atchison, Topeka & Santa Fe has built a second track on the west approach to Cajon Pass in southern California, reducing the grade eastbound from 3 per cent. to 2.2 per cent. The line between Cajon and Summit is on a new location requiring the handling of 1,100,000 yd. of material and the driving of two tunnels. The traffic and operating conditions which made this improvement necessary and the general details of the work were described in the issue of May 1, page 983.

New Haven Improves Method of Electric Operation.—The new system of supplying single phase alternating current power to electric locomotives on the New Haven in order to eliminate inductive disturbances and increase the transmission voltage, was described by William Arthur, assistant engineer with the firm of McHenry & Murray, in the issue of May 1, page 988.

Rebuilding 275 Miles of Milwaukee's Line in Iowa.—The building of a second track with reductions in grade and improvement in alinement on 275 miles of main line on the Chicago, Milwaukee & St. Paul in Iowa, involved the construction or reconstruction of 326 bridges, requiring the placing of nearly 140,000 yd. of concrete and the employment of 2,500 men in the company's concrete gangs. The general types of structures used and the details of design and construction of the two most important bridges, one a steel viaduct 130 ft. high and 2,400 ft. long, were described in the issue of May 8, page 1031.

A Complete Camp Train for a Valuation Party

A Description of the Manner in Which Four Cars Were Equipped for the Use of Engineers in the Field

By J. B. Randall
Master Mechanic, Louisville, Henderson & St. Louis.

In view of the widespread attention which is now being given to the government valuation of railroads, a description of a train of four cars which have just been fitted up under the direction of the writer for the accommodation of the engineers making the valuation on this road, may be of general interest. The cars used were originally house cars in work train service, but in their reconstruction they were so thoroughly overhauled as to lose their former identity. The accompanying photographs show the cars as far as the interesting features were accessible to the photographer in the limited space. Fig. 1 shows the exterior view of the cars with the arrangement of doors and windows. Figs. 2 and 3 show the kitchen and dining rooms, respectively. In Fig. 2 the range with its ventilating hood is shown conveniently located with reference to the tables, sink, lockers, ice chest, etc. The fuel box is located between the range and the end of the car, while the yellow pine refrigerator is shown at the lower left hand corner of the illustration. Ample reserve supplies of ice and fuel are carried on the car in under slung lockers shown in the exterior view. Meats, canned goods, soap, etc., are stored in the upper lockers shown in the interior view of the car, while bulkier supplies, such as flour, meal, sugar, etc., are carried in the bins beneath the long kitchen table. A cupboard utilizes the space beneath the sink, while the water supply of 75 gal. capacity takes the space behind the door. An adjustable ventilator is also provided in the ceiling of the kitchen.

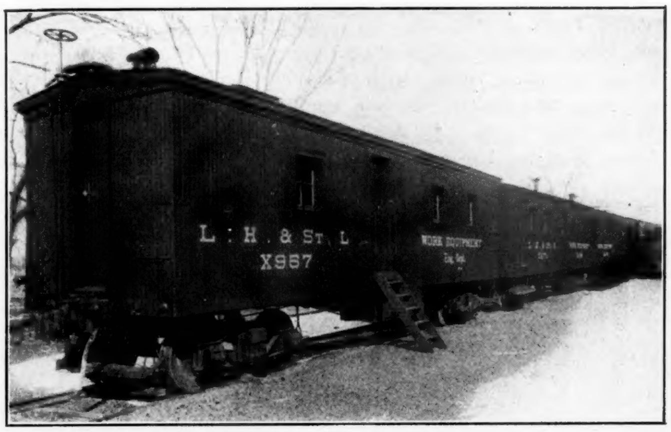


Fig. 1—Camp Train for Valuation Party

Fig. 2—View of Kitchen Showing Range and Storage Bins

The dining room is partitioned off from the kitchen, and has a serving capacity of fourteen, with three tables accommodating four each, and one table accommodating two. These tables, of yellow pine finished in the natural wood, are arranged to fold against the walls of the car. This not only facilitates cleaning the car, but provides a sitting room for the men. The china closet, appearing in the background at the end of the car is conveniently arranged with plush-lined silver drawers, shelving, and a rack for glasses and such bottled goods as catsups, sauces, etc. Ample table ware, of a quality not usually found on equipment of this character, is provided. A linen closet, which does not show in the cut, is built in the other end of the dining room. Illumination and drinking water are provided as shown.

Fig. 3—View of Dining Room

The sitting room car is well lighted and ventilated, and no doubt will prove a source of great comfort to the men after the day's work. The sitting room compartment of the car is partitioned off from the wash room which takes up 7½ ft. of the length of the car. In this wash room are two double wash basins, each provided with gravity water tanks. Each of these basins is equipped with an emergency water tank, also; the water from these will have to be dipped. A big mirror is provided,

while various other toilet accessories will prove very convenient. A nickel plated water cooler is provided here and an oil lamp.

Two poplar reading tables, six reed arm chairs, a slatted bench, and a combination fuel box and seat are shown in

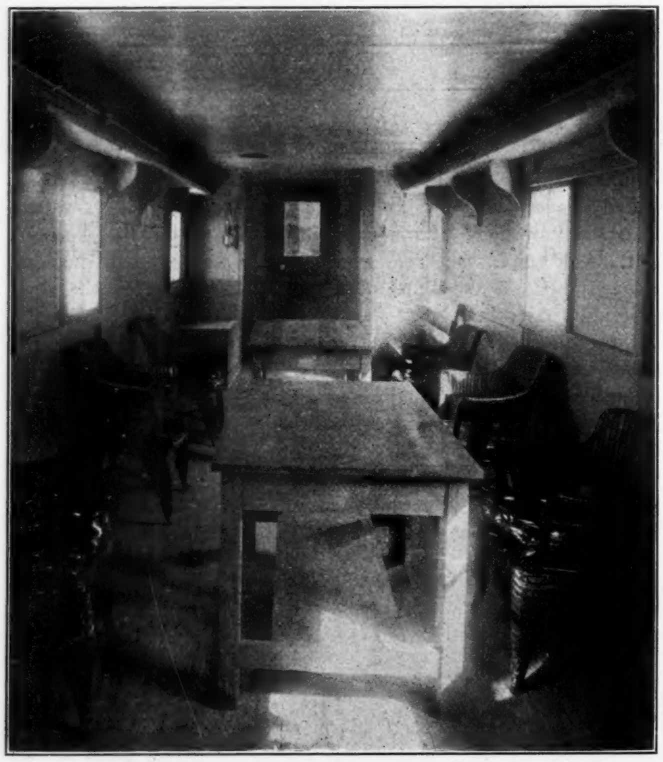


Fig. 4—View of Reading Room

Fig. 4. A heating stove will be put in when needed, its location being indicated by the stove pipe hole cut in the ceiling. Book shelves and coat hooks are conveniently arranged. Five single and two double wardrobe cupboards are provided in this car.

The sleeping room is shown in Fig. 5. There are provided six

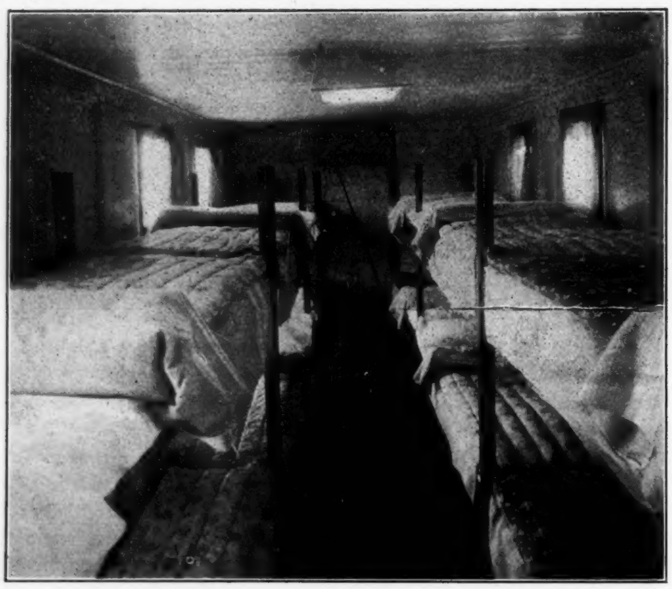


Fig. 5—Sleeping Room With Steel Bunks

double berths, accommodating 12 men. These berths are all steel, securely bolted and anchored to the car floor. There is a novel arrangement of windows: one being provided at the head of each upper and lower berth; there are also two lifting ventilators in the ceiling, equipped with quadrant adjustment, so they may be raised or lowered as desired.

Two partitions in this car cut off the wash room and the cook's room. The wash room is provided with a double wash basin with the same equipment as those mentioned before; a mirror, etc., are also provided. The cook's bunk room contains a double berth, with the same ventilating arrangement as the main sleeping room.

The bedding is of good quality, and springs, cotton pad, sheet, feather pillow, pair blankets, comfort and counterpane are provided for each bunk. For the storage of such articles, there is a corner cupboard built in one end of the car.

The fourth car of the train is essentially the engineer's car, and in it are located his office, his state room and the drafting room (Fig. 6). As shown, the drafting room is well lighted by means of side windows, which open by means of ingenious slides and hinges. The drawing board is supported on adjustable trestles, one of which is shown in the cut. Next to the drawing room, is the engineer's office; equipped with flat top desk, filing cabinets and a large case of drawers. Beyond the office is his state room; with a double bunk, wash basin, etc. Cupboards and lockers provide ample storage for personal attire, etc.

Steps, lounging benches, a portable closet, etc., add to the con-

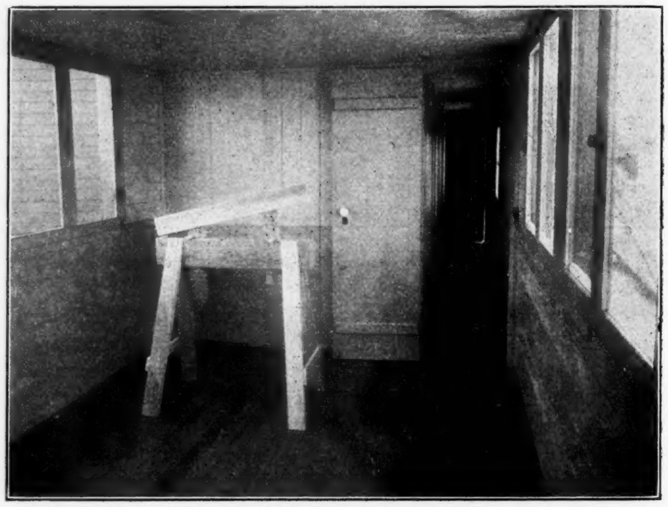


Fig. 6—Engineer's Drafting Room in Office Car

venience of the equipment, while thorough screening of all openings gives protection against insects. Where the nature of the work would permit, natural finish has been given to all woodwork, while the walls, ceilings, etc., have been tastefully enameled in pleasing colors, and the floors oiled or painted as occasion required.

ONE WORK TRAIN FOR TWO DEPARTMENTS*

By C. B. Finnell

Traveling Secretary to General Superintendent, Chicago, Burlington & Quincy, St. Louis, Mo.

Superintendents should not, as a rule, permit a work train to be ordered for a small amount of work for one department without inquiring as to immediate needs of other departments. By following this rule, a work train can often be ordered for a day's work and put in five hours for the roadmaster and five hours for the master carpenter.

It often proves economical and in some cases, on account of the density of traffic, absolutely necessary to build spur tracks at the scene of the work, so the work train can jump in when scheduled passenger trains are due and when freight trains show up. This avoids the necessity of the work train running to the nearest station to get into the clear. This can be worked to great advantage at bridges.

*Received in the contest on The Proper Handling of Work Trains which closed December 27, 1913.

ADVISABILITY OF PERMANENT CONSTRUCTION

By H. C. Estep

All of the older locating engineers can readily recall the time when the position of the finally located line, where alternate routes were available, was determined simply by the fiat of the engineer immediately in charge of the work, or possibly by a division engineer who made occasional inspection trips over the work. Happily the day is past for such methods in location. Such problems are now decided by a careful analysis of all possible lines; first cost, operating cost, and future business being the principal factors considered. But when the question arises whether the type of structures should be permanent or temporary, modern practice frequently gives too little study to its determination.

The writer was recently connected with a line of which the total estimated cost ready for the rolling stock was approximately $10,000,000. Of this the estimated cost of bridges, trestles and culverts, I. C. C. account 6, and crossings and signs, I. C. C. account 15, was $1,557,617 or about 15 per cent. of the total cost of the line.

The high cost of these two accounts was due to the fact that no grade crossings of any road or street were permitted. In the above many of the structures were designed for permanent construction, but included in this amount was $260,000 for wooden trestles. The question came up whether all of the construction should not be permanent, and the engineers were asked to make an estimate of the increased cost that this would involve. This was done, and it was found that this would add an additional expense of $545,000. The work is as yet only partly completed and it is likely that only a small portion, if any, of the proposed temporary structures will be soon replaced by permanent work. On the theory that a railroad is purely a business proposition, let us analyze this and see if permanent work throughout can be justified.

The wooden structures can be safely estimated to last 10 years without renewal. It is true some parts would require replacing sooner, but others, cedar piles for example, will carry their loading for more than twice that period. It is true, too, that these wooden structures require some work done on them, but many of the so-called permanent bridges have exposed steel girders that required painting.

The days for 4 per cent. money for railroad construction are probably gone never to return. Just at present there is not even 5 per cent. money for new construction, but there is much to indicate that the money situation will improve, and that 5 per cent. money will soon be available for this work. On a 5 per cent. interest basis, the case given above would work out approximately as follows:

Permanent Work		Temporary Work	
Cost of permanent work	$545,000	Sinking fund to replace temporary work	$206,700
Interest paid in 10 years	272,500	First cost	260,000
Total cost	$817,500	Interest for 10 years	130,000
		Total cost	$596,700

Using wooden trestles, $220,800 would be saved at the end of the first 10 years, or about 14 per cent. of the cost of all the structures that would come under the Interstate Commerce Commission's accounts 6 and 15.

At the end of the second decade, the situation would be in favor of the permanent work:

Permanent		Temporary	
Interest on first cost	$272,500	Annuity necessary to replace	$206,700
		Interest on first cost	130,000
		Total cost for this decade	$336,700

The balance in favor of permanent construction, considering the second decade only, is $64,200, but at this rate about 36 years would be required to wipe out what the permanent work lost during the first decade.

This would indicate that in many cases permanent work should be recommended only when it is all the word implies —literally everlasting. Where structures carry much exposed steel in their design, it would seem to be just as well to build in wood, if there are no mechanical reasons such as height, length of span, etc., which would prevent wooden construction.

The above case was in the extreme eastern portion of the United States, and based on contract prices of $52.50 per thousand board feet for timber in structure and 50 cents per linear foot for piles in place. There are many points in the West where lumber and piling are much cheaper. At such points it would seem there could be no question but that everything should be built in wood that could be so constructed.

EXTENDING THE DUTIES OF SECTION FOREMEN*

The extent to which the duties of the section foreman can be broadened to include other simple work commonly handled by men of the bridge and building, water service, telegraph and signal departments, is a live question at the present time when the railroads are endeavoring to adopt every means to reduce the cost of operation. Briefly, the main advantage of consolidating these duties under the section foreman is that he is at all times on one section of limited mileage and can attend to any such work with the minimum delay and expense, as compared with sending a man from one of the other departments from the division headquarters. The principal objection made is the inability of the average foreman to perform such work at present. This plan has been tried to a limited extent with the consolidation of the track, carpentry, telegraph and water service work, principally, however, on the smaller lines.

Although at first thought one would consider that the last two departments to be combined would be the track and signal departments, because of the generally considered technical details of signal maintenance, it is here that the combination has been most thoroughly tried and has made the most progress. While this has been to a certain extent the result of local conditions, careful consideration will show that there is at least one definite reason for this condition. The forces engaged in track and signal maintenance are most closely associated today, and it is here that there is the greatest overlap and friction. Representatives of both departments patrol the line daily and they must co-operate in making repairs of any magnitude to signals. Because of this interdependence there is certain to be more or less loss in efficiency,

The first extensive trial of the combination of track and signal maintenance under the supervision of one force was inaugurated on the Union Pacific. In April, 1910, that portion of the Union Pacific main line from Kearney, Neb., west 95 miles to North Platte, was equipped for this experiment. This portion of the line is double track, equipped with Union Switch & Signal Company style "B" automatic signals, and has an average train movement of 28 passenger and 20 freight trains daily. Previous to 1910 there were 24 section foremen at $65 per month each, and seven signal maintainers were employed at $75 per month. In combining these forces the district supervisor of signals was made assistant roadmaster, and this 95 miles of line was divided into 11 sections, each in charge of a foreman at $75 and an assistant foreman at $65. Each gang was provided with a gasolene motor car and with a handpower velocipede, making the customary track inspection and taking care of the signals. This man also tightens bolts and does other work customarily required of the track walker.

This same plan of organization was extended over the double-track main line of the Union Pacific, from North Platte west 135 miles to Sidney in April, 1912, and from the west limit of

*Exhibit B of Report of Track Committee, presented before the American Railway Engineering Association on March 18, 1914.

the Omaha terminals west to Columbus, about 85 miles, on May 1, 1913. On August 1 of this year the maintenance of the Omaha terminals was also placed under this same system, while it is planned to further extend it over the two remaining districts of the Nebraska division, between Omaha and Cheyenne, Wyo., next spring. Thus the signals and track are now maintained by one common force on 351 miles cut of a total of 516 miles of main line on the Nebraska division of the Union Pacific.

While the actual economies resulting from this system cannot be definitely ascertained because of the fact that these districts have been equipped with motor cars and the length of sections has been increased, it is felt by those in charge that combination of track and signal maintenance has contributed its share to the large total savings which have been made. The work, formerly requiring seven signal maintainers at $75 each on the original district of 95 miles and a track walker on each section, has been consolidated under nine assistant foremen at $65 each. While the Nebraska division used to be the highest in point of expenditures per mile for maintenance, it has gradually fallen until it is now the lowest on the Union Pacific, with the single exception of the Colorado division, which consists largely of branch lines. This is in spite of the fact that the main line is double track and handles the heaviest traffic of any division on the system. With this arrangement the friction between the signal and track departments has been eliminated, insulated joint failures have largely disappeared, and the avoidable signal failures have decreased materially.

The Illinois Central was the second road to combine the track and signal maintenance experimentally on 41 miles of double-track main line from Ballard Junction, near the south end of the Cairo bridge, to Fulton, Ky., on October 1, 1912. The sections on this district average four miles in length, and the line is equipped with Hall normal danger gas signals spaced 1½ to 2 miles apart. Previous to the inauguration of this plan the assistant signal engineer spent three weeks instructing the section foremen in their duties, and the division supervisor also spent as much time as he could spare from his other work in training the foremen. At the time this plan was put into operation the salary of the foremen was increased $5 per month and white assistant foremen were employed, the laborers being colored. No increase was made in the length of the sections.

When the signals were turned over to the track forces the number of failures increased greatly. A general foreman was, therefore, employed in September to give his entire attention to the further instruction of the foremen on this district, and since that time the failures have been greatly reduced, although they are still considerably above normal. Also the cost of maintenance of the track and signals is now in excess of that under the old system. However, the experiment on this road has been under way too short a time to enable the officers to draw any definite conclusions, but it is believed that both the cost of maintenance and the number of failures will compare favorably with results obtained under former methods.

The Chicago & Alton is the most recent road to combine the track and signal forces experimentally. About the middle of April of this year these forces were combined on 30 miles of the double-track main line between Bloomington, Ill., and Ocoya. These tracks were laid with 80-lb. and 90-lb. rail with rock ballast and were equipped with Hall signals. Previous to the combination of these forces the track was maintained with section gangs covering an average of four miles of line, under the direction of a foreman at $60 per month, and the signals by a maintainer covering 15 miles of line and paid $75 per month, with a lamp tender at $40 per month. In combining these forces the maintainer was dispensed with and the foreman's wages increased to $70 per month. The length of section remained the same and no assistant foreman was provided. After a trial of about three months the plan was decided a failure, and the maintenance of track and signals was placed on the original basis. It was found that the foremen were devoting an excessive amount of time to the maintenance of signals in their desire to hold the number of failures down to normal, and thus retain their increase in salary. As a result their efficiency in the track work decreased, while the number of signal failures increased, due to the inexperience of the foremen.

The contrast between the results obtained on these three roads is instructive and can be studied with value. The success or failure can be attributed largely to the nature and extent of the preparatory education and training of the foremen in their new duties and to the degree of patient assistance shown by the officers in its development. The Union Pacific found, as did the Illinois Central and the Alton, that the number of signal failures increased at first, as would naturally be expected when their maintenance was turned over to partially experienced men. The Alton's experiment did not continue sufficiently long to overcome this initial period of increased signal failures, and if it had been continued for six months longer these failures would probably have approached a normal condition, as they have done on the Union Pacific and are now doing on the Illinois Central. In fact, on the Union Pacific the average number of failures is now reported to be lower than on the old system.

The degree of success attained by this method on the three roads corresponds largely to the extent of the education of the foremen. On the Union Pacific the men had access to the courses of instruction of the educational bureau on maintenance of signals for several months before the signals were turned over to them, and they had availed themselves very generally of the opportunity of studying the elementary details of signal maintenance. Also, this plan was in contemplation on the various sub-divisions, for some time before its installation, and opportunity was thus given to coach the men in their new duties. After the adoption of this plan on the first sub-division, several men experienced in the maintenance of signals were transferred from this sub-division to the other sub-divisions as assistant foremen when the joint maintenance was put into effect, there to aid in the new work.

While the assistant signal engineer of the Illinois Central devoted three weeks to instructing the section foremen on this line regarding their new duties, the officers now realize that this was insufficient in view of the fact that the division supervisor of signals could devote only a limited amount of attention to the men after this system was inaugurated. This defect has been remedied to a large degree by the employment of a general foreman, who is spending his entire time on this territory, and a marked improvement has been noticed.

While some preparation was made on the Alton, the plan was decided on quickly, and the men were given only a couple of weeks' instruction in connection with their other work. The foremen were not provided with assistant foremen and the responsibility for the maintenance of signals fell upon them in addition to their regular track work. It is difficult to see how men thrown upon their own resources, after this limited amount of instruction, could equal experienced maintainers in performing that work.

In view of the limited extent to which this experiment has been tried, no definite conclusions can be drawn at this time, and the entire subject is still in the experimental stage. At the same time, this method would appear to offer possibilities for economy in maintenance and deserves the careful consideration of railway officers not only in combining the maintenance of the track and signals, but more particularly the combination of light carpentry and similar work. An incidental advantage, which should not be lost sight of, is the possibility of attracting a better class of men from the signal, bridge and other departments because of the increased salary paid for the enlarged duties.

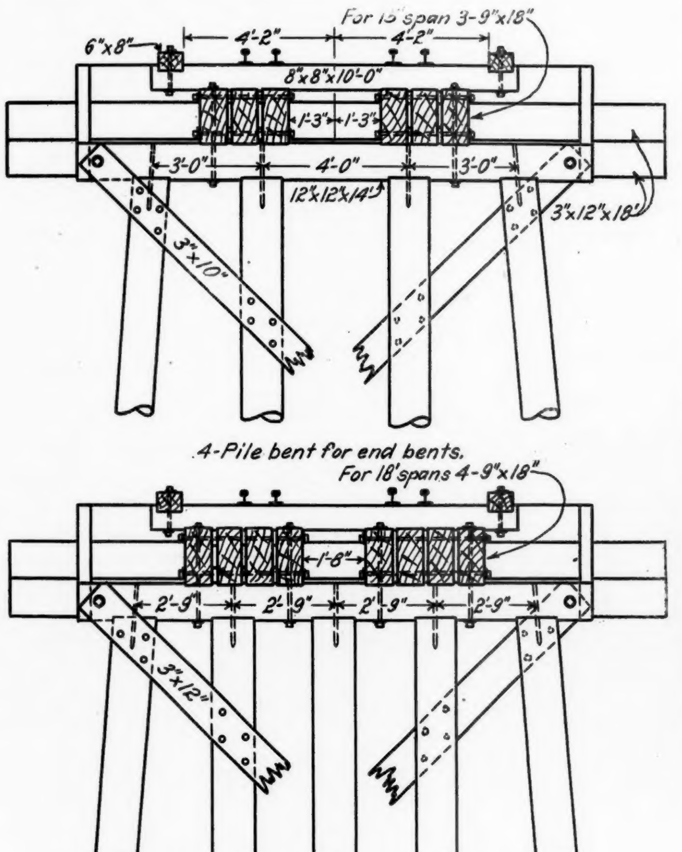
New Equipment for the Russian Railways.—It is reported that in view of the insufficient number of cars on the government railways of Russia, the Ministry of Ways of Communication has decided to order 40,000 cars at once.

Temporary Trestle Construction on the Lake Shore

Practice in Securing Safe Falsework to Handle Heavy Passenger Traffic During Bridge Construction

The importance of the fast passenger traffic on the Lake Shore & Michigan Southern makes it necessary to eliminate slow orders as far as possible during the reconstruction or repair of bridges, and to insure that the temporary structures used in handling such work will be safe under high speeds, more than the usual care is taken in their design and construction. The customary type of construction, with framed or driven pile bents and timber stringers, is used, but by attention to details in designing and building the trestles the necessary strength and rigidity are secured.

The bents contain four or five piles, each carefully driven to secure a good alinement and all are strongly braced with 3 in. by 10 in. or 3 in by 12 in. diagonals. Oak is used for these sway braces in low bents and fir or yellow pine in bents more than 20 ft. high on account of the difficulty in securing oak in long lengths. Double cross bracing is provided on high bents. The horizontal bracing consists of 3 in. by 12 in. timbers on both sides of the bent. All braces are bolted at the ends and wherever they do not come tight against the pile. At other places four boat spikes are used for each fastening. The standard caps and sills are 12 in. by 12 in. oak timbers and 9 in. by 18 in. fir stringers are standard for spans from 12 ft. to 20 ft. For 12 ft. spans, two courses of stringers are used; for 15 ft. spans, three courses; for 18 ft. spans, four courses, and for 20 ft. spans, five courses for main line traffic. Spans as long as 30 ft. have been built with wooden stringers, using needle beams between two layers of stringers, but for spans of this length I-beams are usually preferred. On high speed tracks the ties are framed over the stringers and the guard rails over the ties to give the structure additional stiffness. After the completion of the work the stringers and ties are always reclaimed and are usually used five or six times, or until they are worn out. Caps are saved whenever possible, and also any piles which can be cut off long enough to use for posts in framed bents.



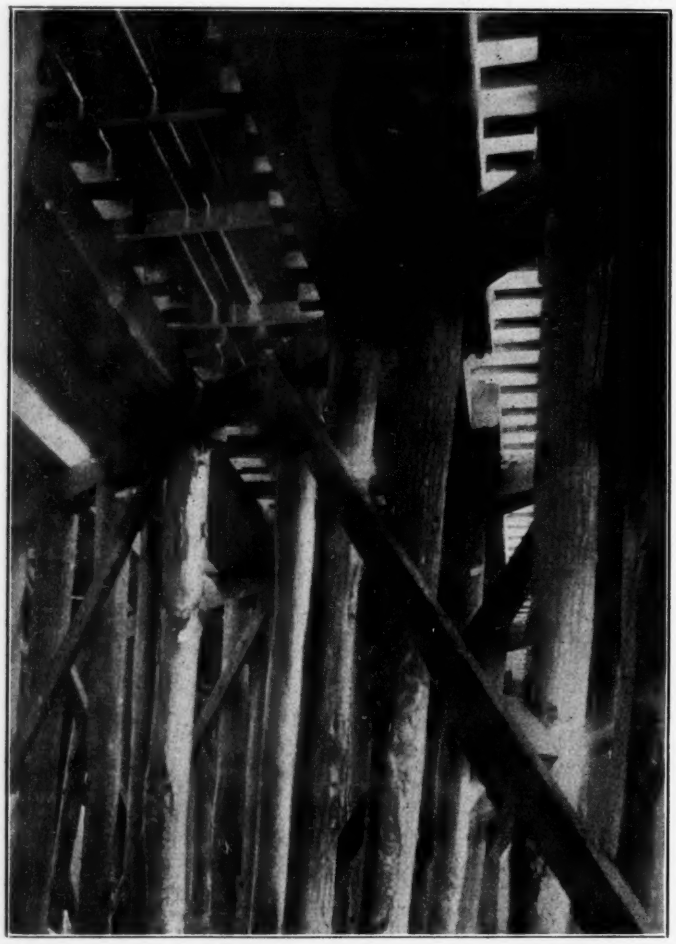
Typical Designs of Timber Trestle on the Lake Shore

In addition to the precautions taken to secure strength and rigidity a plan is worked out for each case to avoid interference of the trestle with the permanent construction. This practice results both in better work and lower cost of construction, for by locating the bents of the temporary structure to clear all permanent foundations the form work is simplified, time is saved in the placing of the concrete and the necessity for leaving voids in the footings to be filled after the completion of the work is eliminated. The possibility of decreasing the strength and stability of a footing by boxing around a pile bent is especially important when such openings must be left in the toes of the footings.

A Typical Side View of Temporary Trestle Showing Good Alinement of Piles and Bents

When a shift in the points of support of a temporary trestle is required to complete the work the successive stages are carefully planned in advance and shown on the drawings for the guidance of the foreman. In building a subway at Sandusky, Ohio, to carry Hayes avenue under seven tracks the bents were shifted twice during the excavation of the street because an underlying strata of rock about 10 ft. below the surface prevented the driving of bents for the full depth. In the first stage of the work the tracks were carried on nine bents driven to rock while the material between these bents was removed. The seven intermediate bents were then replaced by six framed bents set on the rock ledge in the excavated spaces, the stringers having been lapped to allow this change in support to be made without disturbing the deck. With the track supported on these framed bents, trenches were excavated in the rock between the bents down

to the desired elevation. Other framed bents were then located in these trenches to carry the tracks while the excavation was completed and the substructure built, the final location of these bents being carefully planned so as not to interfere with the placing of the abutments or piers.

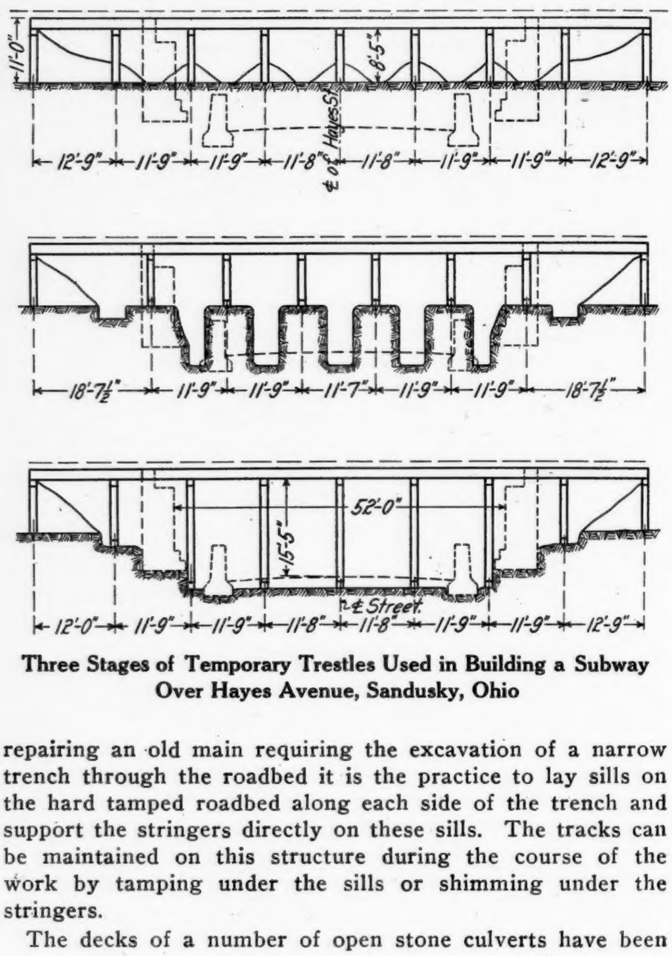


Under Side of a Temporary Trestle Showing Five Lines of Stringers

A typical instance of a single shift is shown in the plan of the East Seventy-ninth street foot subway in Cleveland. Two 15 ft. spans of trestle were used to carry the tracks during the excavation of the street and the placing of the abutments, but as the middle bent would have interfered with the construction of the deck slab, a change in the supports had to be made before this was started. The stringers were blocked up on 12 in. by 12 in. timbers placed on the newly constructed abutments, after the concrete had set, allowing the piles in the middle bents to be sawed off at the elevation marked X-X in the drawing, and the upper portion removed. After the slab was placed and had been allowed to set, waterproofing was applied to one track at a time by taking that track out of service temporarily and removing the stringers and ties. Each track was put back into service before work on the next one was started.

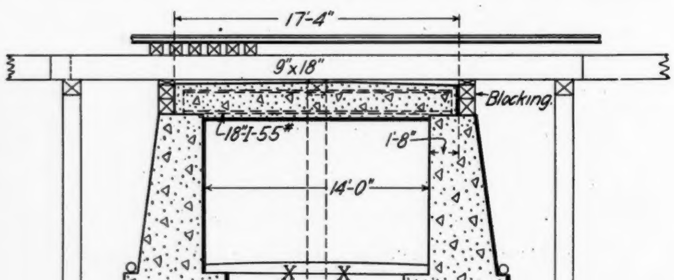
The Deck of a Temporary Trestle Showing Guard Rails Dapped Over the Ties

In placing a new water main under high speed tracks or repairing an old main requiring the excavation of a narrow trench through the roadbed it is the practice to lay sills on the hard tamped roadbed along each side of the trench and support the stringers directly on these sills. The tracks can be maintained on this structure during the course of the work by tamping under the sills or shimming under the stringers.



Three Stages of Temporary Trestles Used in Building a Subway Over Hayes Avenue, Sandusky, Ohio

The decks of a number of open stone culverts have been replaced by concrete slabs without interruption to fast traffic, by supporting the tracks on a nest of rails under each running rail, spanning between the tops of the parapet walls. In one instance of this kind where the span between parapet walls was 8 ft. 7¼ in., seven new 100 lb. rails 12 ft. long were used as stringers and under one of the tracks they were carried on 4 in. by 12 in. cross timbers at each end to allow room for placing the slab.



Sketch Showing Methods of Handling Falsework for a Subway in Cleveland, Ohio

Ice Houses and Their Equipment for Car Icing

Two Recent Installations on the Chicago & North Western with Reasons for Adoption of Various Features

By L. J. Putnam

Principal Assistant Engineer, Chicago & North Western

Late in 1912 the Chicago & North Western decided to greatly enlarge and improve its car icing facilities at Clinton, Iowa, and the writer, as division engineer at the time, was called upon to furnish plans and carry out the work. More recently a similar plant of smaller capacity has been provided at Green Bay, Wis. The small amount of information on this subject available in engineering literature indicates that a description of these very necessary railway appliances as installed at these two locations will be of interest. As both plants are similar, they will be treated together, calling attention to special features at either location.

Clinton, Iowa, is the heaviest car icing point on the North Western system, all through fruit and meat cars being inspected and iced there as necessary. As high as 140 cars per day have been iced at this point during warm weather. Previous to 1913 no modern equipment for car icing was in use at Clinton or any other point on the system. The old house was a 15,000 ton structure which had been enlarged from time to time as the business made it imperative, but no machinery for handling had been provided and ice below the level of the car roof had been hoisted by horse power to the platform.

The house was located about two miles from the Mississippi river, the only available ice field, but at the most convenient point for icing cars as it was served by a track parallel to the main line where through trains could conveniently pull through the siding for inspection and icing without interference with other traffic. Because of the necessity of cutting down delays to through trains it had been necessary to keep a large supply of ice distributed the full length of the platform all the time. This necessitated using ice from nearly all the rooms in the house at one time and exposing all to the warm air. The long time that ice lay on the platform, because of the slow rate at which it could be brought out by the horse hoist, also resulted in excessive shrinkage. As a result of all these conditions it was a usual occurrence to run short of ice during the latter part of the season and be compelled to buy in the outside market at high prices and ship in cars with still further great shrinkage losses.

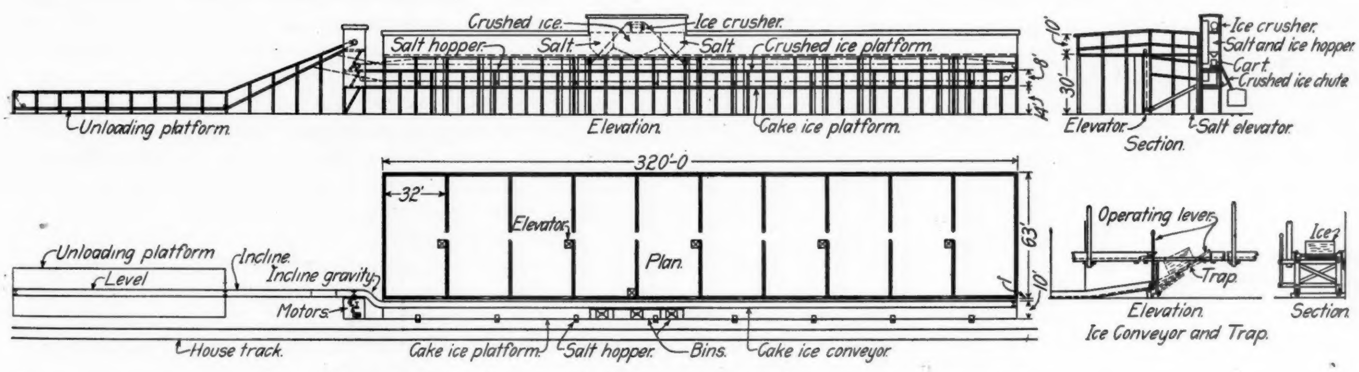
To eliminate these objectionable conditions and to effect the greatest economy, machinery for rapidly handling the ice both into and out of the house was desired in connection with the doubling in storage capacity from 15,000 tons to 30,000 tons. Unfortunately the old house was located in a 20 ft. cut extending back to an important street so that the width of the house was limited to 50 ft., necessitating a total length of 950 ft. to obtain the desired capacity. While contributing largely to the first cost of the house this great length is an advantage in permitting a long train of cars to come to the platform at one time, though a considerably shorter but wider and higher house would have been decided upon except for the natural limitations referred to. The Green Bay house with a width of 63 ft. is much to be preferred where space is available.

Car icing at points like Clinton and Green Bay is divided between meat cars requiring the use of crushed ice in the bunkers and fruit cars requiring only cake ice, the difference being, of course, that a temperature sufficiently low for meat cannot be maintained with cake ice. This fact necessitates means for crushing and for handling both crushed and cake ice at the same time to the same train which is being served at the platform. All cars also require salt with the ice.

CONSTRUCTION OF THE HOUSES

The accompanying plan of the Green Bay house shows the general arrangement of the house and machinery, but does not show the details of the building. This house is 63 ft. wide by 320 ft. long and is divided into ten rooms approximately 31 ft. by 61 ft. The side walls are composed of 2 in. by 12 in. studding spaced 2 ft. center to center. Dressed and matched sheeting 2 in. thick for the lower 10 ft. and 1 in. thick above this is used on the inside placed over building paper. On the outside, 1 in. drop siding is used, also over building paper. The single dead air space thus formed is divided by a partition of 1 in. dressed and matched sheeting nailed to cleats on the studs. The inside one of the two spaces thus formed is filled with granulated cork. The walls thus consist of three thicknesses of dressed and matched lumber, two thicknesses of paper, one 6 in. dead air space and one 5 in. space, cork filled. Partitions between rooms are of 2 in. x 12 in. studding, sheeted on both sides. The roof is supported by four lines of light roof trusses having wooden top chords and rod tension members for the lower chords. Jack rafters on the trusses support a covering of sheathing and prepared building paper. A light ceiling of 1 in. sheathing is suspended from the trusses, forming a dead air space of the depth of the trusses above the ice. Ventilators are provided for each room.

The construction of the Clinton house is somewhat less



Plan and Elevation of the Northwestern Ice House at Green Bay, Wis.

expensive. There the rooms are 25 ft. x 50 ft. Side walls are built up of 2 in. x 8 in. studding with 1 in. shiplap inside and out. After covering the outside sheathing with building paper, 2 in. x 4 in. strips were nailed vertically 2 ft. apart. Another layer of paper and drop siding over this completed the wall, providing in all, three thicknesses of matched sheathing, two layers of paper and two dead air spaces. With these arrangements for walls no sawdust is used, but the ice in one-half of the house is covered with about 1 ft. of marsh hay and is reserved for the latter part of the season. The marsh hay provides a satisfactory protection and when removed leaves the ice clean.

No floor is provided, but old bridge ties removed during the regular bridge repair work are laid down with 8 in. spaces between, covering about 50 per cent. of the area and affording a chance for the water to settle below the ice and pass away into the sand. At Green Bay drain tile are laid beneath the ground to remove the water, but this was not found necessary at Clinton, where the material was dry sand.

An outside waling timber is used at about the mid-height of the house with rods projecting through at each partition. This same wale serves to support the platform joists on the front of the house.

PLATFORMS

The lower platform, which is used exclusively for cake ice, is 14 ft. above the top of rail and is 10 ft. in width. The upper platform for handling the crushed ice and salt is 22 ft. above the top of rail. An upper or third story of the platform near the middle accommodates the ice crusher and the hoppers for ice and salt. The space underneath the lower platform at this point is inclosed for salt storage.

Both platforms are tightly enclosed with continuous sliding doors on the track side so that an opening can be made opposite car bunkers at any point. When no icing is being done the doors are kept carefully closed, excluding the warm air. The upper platform is made as nearly water-tight as possible by using 2 in. plank provided with a caulking edge and caulked with oakum; otherwise the leakage would greatly discomfort workmen below.

HOUSE MACHINERY

Fig. 1 indicates in a general way the kind and arrangement of machinery at the Green Bay house, the arrangement at Clinton being similar. It was at first thought desirable to install the usual type of adjustable gallery conveyor for filling the house, as this has some advantages over any other type for that purpose. It could not, however, be utilized for emptying the house, so it would be used only for a few days during the year. It could not be installed on the front of the house without interfering with the platforms and if installed on the back it would be inconvenient to serve it from cars. It was therefore decided to use one set of machinery on the platforms for both purposes, adapted as far as possible to both uses. The plan adopted has proven economical for both.

The platform conveyors consist of one endless, double chain conveyor with 36 in. oak hold bars every six feet traveling on wooden slides of hard maple. Both runs of the chain are thus used for conveying ice and by making the machinery reversible, ice from any point can be delivered anywhere along either platform.

In filling the house ice is delivered to the chains by inclined conveyors at the end. At Green Bay only one incline conveyor is used and of course ice can be delivered only on one platform conveyor at the same time. This is satisfactory there, as the ice harvesting season is long and the work is not crowded. At Clinton, where a capacity of from 1,500 to 2,000 tons per day is packer in the house, it is necessary to provide an incline with an unloading platform at each end. The incline serving the lower platform conveyor is low and not requiring a great deal of power is operated by a sprocket chain from the hoist that runs the platform conveyors, eliminating separate driving machinery. The incline conveyors are necessarily offset to one side of the platform conveyors on account of the impossibility of delivering ice through the running chain. An "S" shaped slide automatically delivers the cakes from the incline to the horizontal conveyors.

All conveyor chains have offset eye links for receiving the ends of the cross bars, or hold bars. This makes the upper conveyor chain "right" side up so that the cakes of ice can be passed over the chain without interference and the upper slide was at first located on the platform. The lower conveyor chain is necessarily reversed or "wrong" side up and as the cakes could not be passed over the chain conveniently this slide was suspended about 30 in. above the platform and traps were provided in the slide at each door of the house so that the cakes are dropped through. By using a 90 deg. circular chute they are delivered directly into the doors of the house.

During the warm season the cake ice is distributed along the platform in the same manner, making the entire surface of the platform available for ice. The conveyor is also up out of the way where the men cannot accidentally slip or fall into it and possibly receive injury. On account of the advantage of a suspended slide, as shown by use of the lower conveyor, the upper conveyor was later changed to a suspended position similar to the other. The arrangement for traps in the slides is a simple affair made by the carpenters on the work and is shown in Fig. 2. The upper conveyor is raised temporarily to top out the house, as indicated in Fig. 1, after the house is nearly filled. The raising of the conveyor is only a small matter, as it is built with this in view and the work can be done by a few carpenters after work hours without delaying the packing.

Two lowering slides are provided to ease down the cakes of ice to avoid breakage inside the house. These are light affairs readily moved about and consist of light frames carrying conveyors. A band brake on the upper shaft controls the speed. These lowering slides are used only for a few layers when the drop is greatest. Simple slides shifted about to deliver the cakes close to the packers are used otherwise. At Clinton when the lower three layers are placed directly from the cars no mechanical lowering slides are used.

The difficulty of lowering the ice into the house and the danger of breakage was considered a strong argument against the type of machinery adopted and was condemned rather strongly by the company manufacturing the machinery. The plant in operation showed that such fears were largely overestimated and the results have justified the arrangement adopted.

For emptying the rooms of ice below the level of the lower conveyor, gig elevators are installed at the Green Bay house. Ice above the lower conveyor is of course readily removed by gravity. One gig serves two rooms and a 2 h. p. motor in the loft furnishes the power. Light slides are used from the gig shaft to the front doors of the house, delivering the ice cakes automatically to the chain conveyors. The gig machinery with the exception of a few fixed parts is moved from one location to another as the emptying progresses, economizing on the amount of machinery required.

To take the ice from the field at Clinton and load it into cars for transportation to the house, a double chain conveyor similar to the others described and also motor driven is used. This has an incline elevating about 40 ft. above the water and a level run of 600 ft. alongside the loading track. The level portion is on a platform about 3 ft. above the floor of a car so that three or four tiers of ice can be run into the car by gravity. Ten to twelve cars are spotted at one time and about one-half are loaded simultaneously.

The motors at Clinton are all direct current, using power from the street railway company, excepting the one motor at the river, which is driven from a generating plant which operates the draw-bridge. The motor driving the horizontal conveyors and the first story incline at the house is 30 h. p.,

the motor on the high incline is 10 h. p., the gig motor is 2 h. p. and the motor at the river is 20 h. p. The 30 h. p. motor is perhaps larger than necessary as the load when running is only about 10 h. p. Starting the chain when loaded or when slightly frozen makes it advisable to have ample capacity.

ICE CRUSHER AND SALT ELEVATOR

The ice crusher is placed in an elevated house as shown, sufficiently high that the crushed ice drops into a bin and is hoppered to an outlet three feet above the upper platform, high enough to deliver into the boxes of two-wheeled dump carts which are used for handling the crushed ice. A salt hopper adjoining is provided with a similar outlet so that when a cart is loaded with ice it is pushed along to the salt hopper and receives the necessary proportion of salt. Both the ice crusher and salt conveyor are operated from the same motor. The motor used is the 10 h. p. motor employed during the filling season at the high incline. The salt elevator is a simple bucket and chain affair loading from a boot at the ground level and discharging into the salt bin above. For the charging conveyor to the ice crusher the upper platform conveyor is carried up over an incline to raise the ice to the necessary elevation, as shown. Idlers are used at the angles in the chain as elsewhere.

HARVESTING THE ICE

The Clinton ice field is on the Mississippi river at a place with only a sluggish current, but enough, nevertheless, to require prolonged zero weather to freeze ice of suitable thickness for packing. The size of the field is also limited, containing only about 20 acres. With 12 in. ice, the minimum considered advisable to cut, only about 20,000 tons is available from the entire field. Usually the thickness increases so as to make up part of the deficiency and ordinarily a part of the field can be re-cut. Under exceptionally unfavorable conditions a certain amount of ice has to be cut elsewhere and hauled in by trains.

The field is watched closely after it freezes over and all snow possible is scraped off by teams. This not only prevents snow ice, but removes the snow blanket which would greatly retard the further freezing. The field is exposed to the sweep of the wind and rarely accumulates snow unless it is very wet. The removal of snow is therefore a small item ordinarily.

Cutting is started with ice of 12 in. thickness. Plows are used, cutting both ways as deeply as the ice will stand. Cakes are cut 22 in. square, as the size seems preferable for car icing, though much smaller than is used in ordinary commercial houses. Two cakes of this size can be delivered to each hold-bar on the conveyors, so that the handling is as rapid as with cakes double the size, but the cutting is considerably more expensive. As the hold-bars are spaced 6 ft. apart and the chain runs at 100 ft. per minute the two cakes per bar mean 33 cakes per minute, which, with 12 in. ice, aggregates 2.8 tons or 1,680 tons in 10 hours.

This rate, of course, cannot be steadily maintained and 1,000 tons in a nine-hour day is considered a good day's loading. Night loading is resorted to if the lateness of the season and the condition of the ice seem to justify pushing the cutting to the limit. Ice loaded at night is held until day, as the capacity for packing is greater and the entire output can be put into the house by the day shift working a little overtime if necessary. The house is well lighted by electricity. Cluster lights on portable poles are used on the ice field in sufficient quantity to make the night work almost as economical and safe as the day work.

The ice cakes are handled flat until delivered in the packing room. There the cakes are turned on edge by the tongmen doing the packing. The small size of the cakes makes this easy and the varying thickness of ice makes no difference with the tiers in the house. Each tier of ice contains the same tonnage, which is of some help in removal. If the cakes were packed flat it would be necessary to trim them to the same thickness at the field conveyors. This would waste much ice in any case and as the thickness was increased from day to day would make continual trouble in packing. A car not switched in regular order would come in with thicker ice, making uneven layers. It was therefore concluded best to omit the trimmer and pack on edge.

The filling at the Clinton house is handled in the following manner. As many cars as can be accommodated at the two platforms (five at each) are spotted and unloading is done as rapidly as possible. Four men on each platform load the conveyor, each man loading a cake on every fourth hold-bar in regular order. If two cakes per bar are being handled the number of men is doubled. Each man thus has exactly the same work to do and performs it with clock-like regularity. A small amount of ice accumulates on the platform by the time the cars are emptied, which will keep the conveyor busy while new cars are being spotted so that a continuous supply of ice is delivered to the conveyors.

As the lower three tiers in the rooms are placed by gravity directly from cars, a small start is made in this way the first day while the field is being opened up and the organization perfected before the conveyors are in use. With the work under way four rooms are being filled on each lift simultaneously. The ice delivered to each conveyor is therefore divided in distribution to four points. Three men on the platform operate three traps serving the rooms, the fourth trap farthest from the platform simply being left open. Each man drops the cakes from every fourth bar through his trap, distributing the cakes equally to the four packing crews on each level. Inside the rooms sufficient men are employed to keep the slides arranged and remove and pack the cakes as they come in. Plenty of sub-foremen and a few extra men are always found economical, as a few minutes' blockade and delay to the conveyors will more than offset the expense.

No chip conveyor has been installed and the first season's work did not indicate that such would be necessary. A few chips accumulated on the platform and in the cars, but only very few reached the conveyors. A slatted section of the slide at the receiving point on both horizontal conveyors let the chips fall through, but the quantity was so small that they accumulated under the lower platform and did not have to be removed.

EMPTYING THE HOUSE

Emptying the house while comparatively slow is also equally simple. All ice down to the level of the lower conveyor is removed by gravity. Below that point it is elevated by the gigs to the slides serving either conveyor as desired. The icing crew fills the crushed ice bin and distributes cake ice along the lower platform between trains, running the conveyor in the direction required to serve the room being emptied. The crew is then ready for the quick despatching of cars as they are spotted at any point along the length of the platform. A small crew can be kept busy all the time without any considerable delay to traffic. Small salt boxes are located on the front of the lower platform, as shown, so that where cake ice is being used the man on the car can take from the box with a scoop shovel what salt is necessary. These small salt boxes are filled through a fixed chute, opening on the upper platform. Salt from the central bin is wheeled to these chutes and dumped to fill the boxes below.

Sheet iron chutes hung by hooks are lowered from the upper platform to convey the crushed ice into the bunkers. These are light and are transferred from point to point as needed. Light wooden slides are used for running the cake ice into the bunkers.

COST OF THE ICE HARVESTING

As yet only one harvesting season has passed since the erection of the Clinton house and this one season was the

most unfavorable known for many years. The field was entirely open until late in January, when a few cold days made ice of 10 in. thickness. It looked then as though but little might be expected there and cutting was started on the 10 in. ice. After two or three days the weather again moderated and a rain made it necessary to suspend work and discharge the crews. After two weeks of waiting another cold period put the field in workable condition with 12 in. ice and packing was again commenced. Fortunately the weather continued cold for several days and the ice thickened to 14 in., the heaviest of the season. A night cutting crew was put on and the work rushed to the limit. Teams were also engaged and a small field farther down the river, but near the house, was cut over. About 8,000 tons was obtained in this way. One train load was also shipped in from the north. Under all of these adverse conditions the cost was necessarily high. The organizing of two virtually new crews made a large item of expense, as did also the effort to put up thin ice on a flooded field. Including all expense for train service, current, etc., the ice handled on cars cost 52 cents per ton, packed in the house. With average conditions this should be reduced from 25 to 40 per cent.

KEEPING LABORERS

By C. L. Van Auken

Numerous articles have been published on the best methods to pursue to keep laborers satisfied in the employ of the company. Among the many conditions which have a direct bearing on this are discipline and the attitude and characteristics of the foreman.

There are almost as many kinds of foremen as there are laborers. A foreman, however, is assumed to have a considerably greater degree of intelligence and to be able to adapt himself rapidly to the changing conditions under which he works. The day of the profane and wordy driver of men is over. As a rule, it is no longer possible to keep a gang of men working for such a foreman in these days of labor scarcity. Neither is there a place for a lazy foreman under the present conditions, for a foreman must constantly be planning and devising methods to hasten the work, and overseeing his laborers and assistant foreman to eliminate lost motion. Neither is there a place for the foreman who is over indulgent or over familiar with his men. Nowhere is the old saying "familiarity breeds contempt" more aptly illustrated than in the relations between foreman and laborers, or for that matter between any employer and employee. Once let a gang of laborers obtain a feeling of comradeship with the foreman, and discipline ceases. The type of foreman needed is one with unlimited patience, but one who exacts strict obedience, while treating his men as human beings. Discipline is not a result of loud talk. Some of the most quiet men exact and obtain the strictest obedience.

It is a fact that a gang which is well organized and under firm discipline will remain on a job long after the poorly disciplined and poorly organized gang has left. It is human nature to dislike working for an incompetent or a weakling. It is surprising what can be sometimes accomplished with a desultory bunch of laborers when they begin to see that their every move is resulting in the greatest progress for the energy expended. Gradually interest is awakened, and once the interest of even the poorest class of labor is aroused the results can be doubled or tripled. The first feeling toward a foreman who "means business" all the time is quite likely to be one of dislike, but if a little tact is sprinkled in with the discipline, this feeling can soon be changed to respect, and the foreman that has the respect of his men will keep them. Organization and discipline go hand in hand. Proper organization guarantees the greatest results for the amount of energy expended, and discipline is necessary to obtain this organization.

Discipline should be tempered with good judgment and occasions arise when a little of it goes a long ways. For instance, I recall an occasion when a general foreman discharged an interpreter with a gang of foreigners on a new line, many miles from "civilization." The result of this display of discipline was that the entire gang quit work until the interpreter was reinstated. The circumstances were such that a new gang could not be obtained immediately, and it was absolutely necessary to put the men back to work again. The final result was no discipline.

This illustrates the fact that occasionally it is well to weigh carefully those orders which are given, provided there is a possibility of the order causing ill feeling and a general strike. Many times such a crisis can be passed over by using a little tact, and not getting into a situation where it is necessary to make a display of authority. Then later, with the laborers in a different mood, the order may be insisted upon with assurance that it will not cause a strike. This does not mean that the wishes of the laborers should not be crossed, but it does mean that it is folly to arouse the antagonism of a gang for a trivial cause, or just to show authority, especially when the gang is in a bad humor, as when surfacing in muddy ballast after a rain, working in a rain, etc.

If a foreman makes a study of each man and adapts his methods to the particular characteristics of each man, it adds a strong inducement to the laborers to continue with him. Thus some men must be driven, others will work on suggestions alone, others must be led, and others must be influenced by instruction and example. Housing conditions, working conditions, rate of pay, etc., all have their effects on holding or driving away laborers, but the characteristics of the foreman, as expressed in discipline, organization and intelligence, are of very vital importance in the solution of the problem.

ORGANIZATION FOR PERMANENT WORK TRAIN SERVICE*

By G. J. Sharkey

New York Central & Hudson River, Kingston, N. Y.

A work train crew should consist of the regular train crew, an experienced conductor, a foreman who is familiar with all kinds of track work, and a force of 15 laborers who have had experience in track or section gang work. The equipment of the train should include a regular caboose, laborers' riding car and tool car. The caboose should be equipped with suitable table or desk for making out reports and properly caring for report blanks and train service supplies. The laborers' car should be furnished with seats running lengthwise of the car for the convenience of the men while riding over the road; also a large stove to warm their dinner pails or dry their clothing, as they are often forced to work in inclement weather, as at slides, wrecks, etc. These little attentions to the men create satisfaction which is the secret of good results.

The use of a permanent work train not only insures a conclusion of a particular piece of work, but does away with constant interruption of regular work and the disorganization of methods. A work train is a valuable safeguard in time of wrecks, derailments, slides, etc. It is not only valuable in its availability as a means of getting wrecking equipment to the scene of trouble, but its force of laborers are at hand to assist in the wrecking and the repair of tracks.

In handling work trains the secret of good results is perfect co-operation. This starts with the despatcher in giving the conductor protection and opportunity to cover his ground. Then the conductor should be alert to cover the ground laid out, and the foreman and men correspondingly interested in the work. A fair day's work should be mapped out by the supervising head, as there is a certain amount of pride in having accomplished the work desired, which acts as a stimulus for work to follow.

*Received in the contest on The Proper Handling of Work Trains which closed December 27, 1913.

GRAND CENTRAL TERMINAL 100-TON ELECTRIC CRANE

A double end electric wrecking crane, with independent 100-ton capacity cranes at each end, designed for the underground clearances and conditions existing in the Grand Central Terminal, has recently been delivered to the New York Central & Hudson River. While primarily designed to meet Grand Central Terminal conditions, it is also adapted for use on the main line of the electric division, where operating conditions and clearances are similar to those on steam roads. This machine may be despatched at high speed under its own power to the scene of an accident anywhere on the electric division. It combines the functions of a crane with many of those of a high power electric locomotive. It is equipped for high speed, independent operation, with air brakes, whistle and all necessary fittings.

The crane had to be designed to attain its capacity in the restricted space of the express level deck of the terminal, where head room for raising the boom and room at the side for slewing were both restricted and in addition where excessive concentration of wheel loads must be avoided. In case of a wreck underground, if possible, the wreckage would be lifted clear of the track and the crane would then back out with it. However, if the crane could not raise the damaged equipment off the track—either on account of lack of head room or because of the size of the piece—one end would be lifted with the main hoist and a special truck would be placed under it with the auxiliary hoist. The crane would then drag away the load.

The car body is 67 ft. long, with a wheel base of 51 ft., and is carried on two compound trucks, made up of two four-wheel trucks each. A cradle on which the car body rests allows the compound trucks, as well as each single truck, freedom to swing when taking curves. Complete air brakes are provided, also a hand brake wheel at each end. There is a comprehensive system of air-operated telescopic outriggers or jack beams used to add stability during heavy lifting and to distribute the load over a greater area. These are controlled by valves with suitable levers, and are instantaneous in action, thus combining ease and speed of operation.

At each end of the car is a complete independent crane, with a structural mast and boom, accurately turned roller path and rollers, and the slewing mechanism. All of the motions of operation may be performed independently, and with loads up to the capacities of the motors may be performed simultaneously. A special feature is the air operation of all clutches to insure quick and sure engagement and release. Such a system with suitable levers is provided at both ends of the car, each operating its respective end, except for the propelling, which may be controlled from either end.

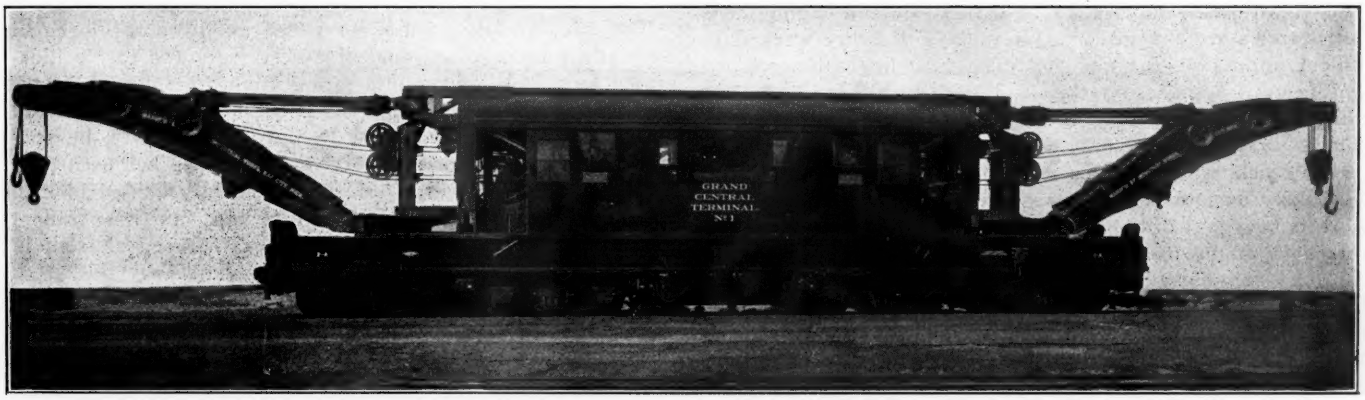
The electrical equipment includes six principal motors with a total of 1,100 h. p., four of which rated at 200 h. p. each are used for propelling, and two at 150 h. p. each for hoisting and for operating the machinery. The propelling motors are direct connected to the axles of the compound trucks, two at each end of the car. They are arranged so that all four may be used for traveling, or, if desired, only the two at either end. They are capable of operating safely on fluctuations of line voltage between 300 and 750 volts d. c. Control is from each end of the car, the controllers being arranged for connecting the motors in series, series parallel and parallel. There is also an electrically driven air compressor.

For intermittent and emergency service, as might be required with the third rail out of commission, or when suitable cable connections could not be made with a feed line, there is installed on the crane a high capacity storage battery. This is ready for service to operate the crane independently of any outside source of power. It consists of 230 cells, and has a capacity of 75 amperes for 8 hours, with a maximum discharge rate of 350 amperes for 2 hours. There is a complete testing and charging outfit, in order that the battery may be charged anywhere that connection can be made with a feed line. At each end of the car is installed a switchboard suitably equipped with lamps and instruments, including an ampere-hour meter for use with the storage battery.

The operation of hoisting is performed by a train of cut spur gearing. There is a brake of sufficient capacity to hold the maximum load in any position, or to lower it at a low rate of speed. A combination clutch and brake is provided for despatch lowering of the block. In addition there is a ratchet and pawl of ample strength to hold the maximum load when the clutch is disengaged and the winch heads are in operation. These winch heads are on either side of the crane, are of 25 tons capacity and are independent in operation of all other mechanisms. The auxiliary hoist is arranged to operate at the same radius as the main block, or at different points on the boom. The boom hoist or radius varying mechanism may be operated with the maximum load suspended from the boom.

With all four propelling motors in use the crane was guaranteed to travel at the following speeds when hauling an 80-ton rolling load: 25 miles per hour on straight level track; 15 miles per hour on a 2.7 per cent. grade; 12 miles per hour on straight level track with the addition of a 50-ton suspended load. As a matter of fact, actual speeds greatly in excess of these were attained. At the formal test conducted by the railway the crane propelled itself at a rate of 34 miles an hour while hauling an 80-ton rolling load. Satisfactory operation is also possible using only the two motors at either end of the car, with resulting speeds about 60 per cent. of those when all four motors are used.

In general the following capacities are provided for: On solid foundation with outriggers—100 tons at 24 ft. 2 in. radius



Heavy Double End Electric Wrecking Crane for Use in Grand Central Terminal and on Electric Division of New York Central

straight ahead or 6 ft. 6 in. either side of center; 100 tons at 22 ft. radius straight ahead or 12 ft. either side of center; 100 tons at 13 ft. 8 in. swinging 180 deg. Without outriggers: 50 tons at 24 ft. 2 in. radius, straight ahead; 25 tons at 13 ft. 8 in. swinging 180 deg.

This crane was designed and built by the Industrial Works, Bay City, Mich., from specifications prepared by a committee consisting of C. H. Quereau, superintendent electrical equipment (chairman); H. A. Currie, assistant electrical engineer, and B. J. Buell, wrecking master, of the New York Central & Hudson River, and was furnished through the George M. Newhall Engineering Company, Philadelphia, Pa.

ADVANCE PLANNING FOR WORK TRAINS*

By H. R. Clarke

Roadmaster, Chicago, Burlington & Quincy, Burlington, Iowa

One of the most important factors in work train service is the train and engine crew. It is largely up to these men to get out to the work and to make use of every minute possible without unduly delaying other trains. A conductor who waits for the despatcher or some one else to tell him he can go will not get much done, but one who knows just what he wants to do and takes advantage of every chance to move will do a lot of work even on a heavy traffic division.

In this same connection if the same crew can be kept on the job steadily it will help greatly as a rule. Sometimes the endeavor to keep the same crew on the job brings us into conflict with the seniority rights of the train and engine men, but if crews are changed every few days or every week it is almost impossible for any roadmaster to line the work up and keep it going smoothly and without delay. Another thing to be considered is the class of engine used. If it is some light work where only a few cars are handled at a time, such as picking up old ties, loading rail, etc., a small engine will likely be more satisfactory than a large one, but if the work is heavy, such as unloading ballast, where a number of cars have to be handled, a large engine, which can handle the load and move easily and quickly will be found to be economical.

A little forethought in distributing cars of material along the line before the train starts will often help greatly. For instance, in unloading ties where 15 or 25 cars are handled in a day and 50 to 100 miles are to be covered in the four or five days the train is out, if the loaded cars have been scattered along the territory to be covered, four or five at a station, so the loads can be picked up and the empties set out as the work goes on, it will speed up the work more than one would think.

The number of men to be used depends on the class of work being done. In unloading ballast by hand 30 to 50 men can be used to good advantage. When unloading from Rodger ballast cars or with a Lidgerwood and plow from Haskell & Barker cars very few men are needed. In unloading ties from stock or box cars I have found 4 to 6 men in a car is a safe and economical gang, and that 5 or 6 cars can be unloaded at a time as easily as one.

When there is work enough to justify it I have found that a permanent work train is very satisfactory. Assign a regular train and engine crew to the work, with a small gang of from 10 to 20 men, provided with cars for sleeping and eating. The conductor can also act as foreman, provision for this being made in the schedule. This outfit can then report to the various roadmasters and master carpenters on the division as they have need of a work train. There will be enough men with the train to handle many kinds of work, such as loading and unloading rail, picking up old ties or timbers with a derrick, etc., and if more men are needed for some work, a fair sized gang can usually be made up by picking up two or three section gangs. I think every one will agree that picking up six or eight section gangs to provide a gang for work train use is expensive and unsatisfactory. As a rule the men are late getting to where they are wanted or have to leave early for home, on account of train service, and there is generally more or less overtime to be explained. Also the sections are unprotected while the men are gone. With a regular work train and work train gang the outfit can be laid up wherever there is coal and water or coal can be hauled with the train if necessary. In this way the crew can tie up at points convenient to the work and put in the time working instead of running over the line picking up men.

Whenever a work train is used everyone concerned, and especially the roadmaster, is anxious to make a good showing of work done, but at the same time care should be taken to do the work in such a way as to make as easy as possible the work of the gang following the work train. A little care and perhaps a little more time, when the train is on, may make a large saving when the extra gang comes to lay the rail or put in ballast. As we all know, nothing is more exasperating or more expensive than to have to truck rail or ballast back and forth when an extra gang is on the job.

*Received in the contest on The Proper Handling of Work Trains which closed December 27, 1913.

INTERESTING USES OF A GASOLENE MOTOR CAR

The wide variety of uses to which an ingenious foreman may adapt the ordinary gasoline section motor car is illustrated by the following interesting applications made by R. B. Johnson, extra gang foreman of the Chicago, Rock Island & Pacific, Mason City, Iowa. On August 28, 1913, he purchased a 3 h. p. Fairmont motor car which he has used continuously since that time. He has frequently hauled 14 men over the road with the motor car alone and with three trailers has hauled 45 to 50 men and all tools at a speed of from 12 to 15 miles per hour.

In one instance, while clearing up a derailment, it was necessary to load three pairs of trucks on a car. Instead of sending to the nearest terminal for a derrick, a flat car was spotted opposite the trucks and they were pulled up over skids onto the car by means of a rope attached to the motor car. The three trucks were loaded in this manner in 45 minutes with the assistance of only four men.

The car has also been arranged to operate a 32 in. circular saw for cutting up ties and other timber by replacing the belt driving the motor car with a longer belt. Over 1,200 ties have been sawed this winter with no delays other than those occasioned by the necessity of resharpening the saw.

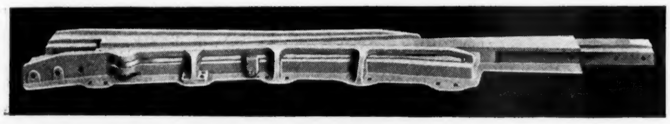
A dynamo has also been connected to the fly wheel of the engine to provide light for use in clearing wrecks and in patroling the tracks at night. For work at wrecks, a large tubular lantern with a reflector and 100 ft. of wire is used, enabling the operator to work at a considerable distance from the motor car. Three other lights, each equipped with 25 ft. of wire, have also been provided. In addition to service at wrecks these lights are of considerable assistance when patroling the tracks at night. A foreman is frequently called out after an engineer has reported cattle on the right of way and with the large light he can see out to the fence on either side and readily find the stock. If he desires to examine a bridge or culvert after a storm, he can go down under the structure with this light and make a careful examination. To provide against the stopping of the engine, this car has been equipped with a storage battery, which will run these lights about five hours. This battery is then recharged from the dynamo when the engine is running.

THE CONLEY "BIG TERMINAL" SPRING FROG

A new spring frog of solid manganese is being manufactured by the Conley Frog and Switch Company, Memphis, Tenn., which is similar in general design to the Conley class "C" manganese frog with the exception that the main line is given a solid bearing through the frog. The easers at the toe and the heel riser lap over the joints about 18 in., thus eliminating pounding at the joints.

In common with other Conley frogs, the new design includes two elevated guide rails on the edges of the frog which replace the usual separate guard rails located inside the outer rails. The guide rail on the spring wing side is designed to hold the spring rail in place and prevents double flange wheels from throwing it out. If the spring rail were broken, the frog would act as a rigid frog. Care has been taken in perfecting the design to eliminate difficulty from snow and ice, even the spring being encased under the frog so that it cannot be damaged by the elements or by dragging rods or brake beams.

Spiking flanges are cast on the base of rail so that the inside spikes give the same amount of holding power as the outside

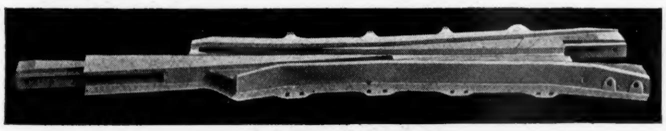


Spring Wing Side of the Conley Frog

spikes. This anchors the frog to the ties and eliminates the tendency to creep towards the head block, which is often the cause of derailments on double track lines with trailing switches where the traffic is all in the same direction. Such creeping results in tightening the gage, rendering the separate guard rail inoperative. Creeping of the spring wing is prevented by a large steel pin which holds it in place at the hinge end.

The spring wing is of solid manganese 2 in. deep and 5 in. wide, giving a section of 10 sq. in., or a little more than a 100-lb. rail. The spring wing rests on a solid base which keeps it at the same elevation as the rigid side of the frog, even when traffic is practically all on one track. No loose foot guards are required as the construction is such as to prevent men from getting their feet caught in any part of the frog. No body bolts or castings are used in this design.

The guide rails are provided with an easy spiral at both ends



Rigid Wing Side of the Conley Frog with the Spring Wing Open

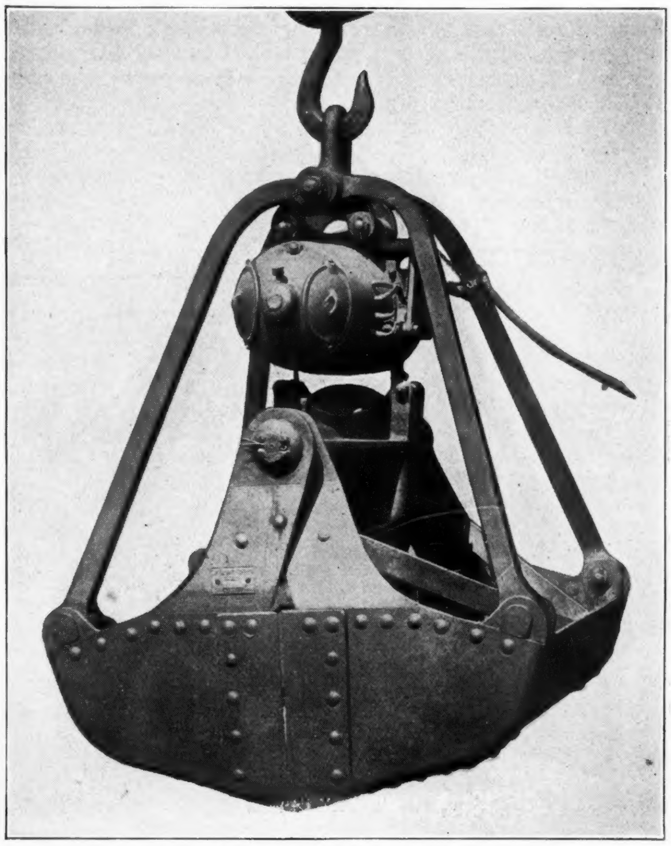
so that no shock occurs to wheels in entering or leaving the frogs. It is claimed that perfect wheels will pass through this frog without any vibration or lateral movement, and that worn wheels will only be moved by an amount equal to the thickness of the wear, such movement occurring only where the wheel is binding the frog side of the track. It is claimed that the new design will eliminate derailments caused by loose wheels or bent axles which frequently cause the wheels to strike the points of frogs.

One application of the new spring frog which is very efficient is on turnouts into coach yards where long Pullman cars are handled. As the force pushing cars into a siding makes an angle with the center line of the cars, this force has a tendency to throw the weight of the car to the wheels on the frog side, causing the wheels on the opposite side to raise slightly off the rail. With separate guard rails this condition may cause the wheel to mount the guard rail and allow the opposite wheel to take the wrong side of the frog point. This difficulty is, of course, eliminated by having the guard rails made an integral part of the frog.

AN ELECTRIC MOTOR OPERATED CLAM SHELL BUCKET

A clam shell bucket has recently been placed on the market by the Hayward Company, New York, which is opened and closed by a motor-operated self-contained unit attached to the upper center of the bucket. This device was originally intended for use in foundries and around shops for handling coal, sand and gravel, but in the past few months it has been successfully used for handling concrete material and in some cases for excavating sand and loam.

The bucket can be attached to or detached from the operating machinery as quickly as a skip box or magnet. It is only necessary to hang the bucket on the hook on the end of the operating line and plug in the electric cable. It can be operated by a trav-



New Motor Operated Clam Shell Bucket in Closed Position

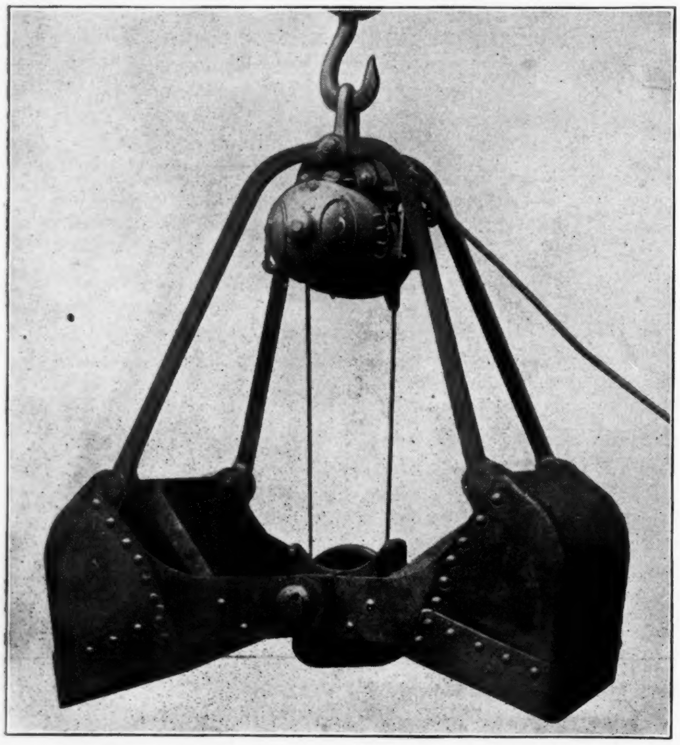
eling crane or any type of hoisting machine having one or more drums available for bucket work. The load can be dumped gradually if desired in order to prevent injury to cars or hoppers which the bucket may be loading. As the closing unit is an integral part of the bucket, all of the weight is in position to help the bucket dig, and there is no uplifting tendency during the closing operation. Another advantage claimed for this bucket is that all of the space between the ground and the boom less the height of the bucket itself can be used in digging. In this respect, its operation is the same as a two line bucket. No space is wasted for an operating line when working in cramped quarters or under limited head room. It can be raised or lowered by two or more parts of line, making its use possible on machines having a small hoisting power on a single line.

The bucket consists of two parts, the bowl section and the closing unit. The buckets are made in sizes from ¾ yd. up and are operated by either direct or alternating current motors. The

motor, winding drum and clutch are encased in a weather and dust proof housing which is provided with hand holes through which the working parts may be oiled and the brushes cleaned.

All circuit breakers and limit switches have been eliminated and the electrical construction and wiring have been reduced to a simple form. The motor cannot be overloaded as the disc clutch is arranged to slip before the overload danger point is reached. The controller handle may be thrown on and left in position during the whole cycle of operation without danger to the motor. The winding drum stops automatically when the bucket is filled. When the bucket is opened to its limit and the load has been discharged, a dog engages the drum, stopping it, but leaving the motor free to rotate even though the controller handle has not been centered. This allows the operator to work in safety, even when he cannot see what the bucket is doing.

The bucket movements are controlled through an electric conductor cable which is lead from the controller to an automatic cable takeup reel and from the reel to the motor on the bucket. The controller is of the rheostatic type and can be arranged for two to four speeds in both directions. The operation of the bucket is simple, as the controller handle in one position causes



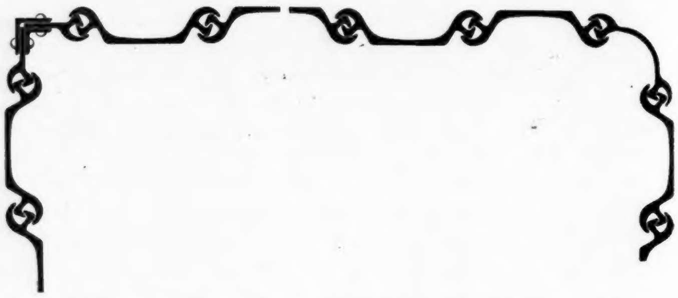
Self-Contained Clam Shell Bucket in Open Position

the bucket to close gradually, stopping automatically when closed, and in the opposite position, causes the bucket to open. The automatic reel is operated by spiral springs and serves to take up the slack in the conductor cable as the bucket is raised from the ground. It not only holds the cable taut, but also serves to steady the bucket and keep it from twisting. This reel may be located at any convenient point. The action of the drum is automatic as the lowering of the bucket and paying out of the electric cable winds up the spring. The raising of the bucket permits the spring to unwind and the reel to take up the slack. Provision is made for varying the tension on the cable and for lubricating the working parts.

RAILWAY CONSTRUCTION IN RUSSIA.—Permission has been granted for the construction of a new railway line from the Alexeevsky-Gai station of the Riazan Ural Railway to the Chardjui station of the Central Asiatic Railway, the length being approximately 1,134 miles.

A NEW LACKAWANNA STEEL SHEET PILING SECTION

A new Lackawanna steel sheet piling section is now being rolled for use in 90-deg. corners of rectangular cofferdams or detaining walls, as shown in the accompanying figure. This can be rolled with either the hook or the guard on the outside. Heretofore corner members have been fabricated as shown in the illustration. Rolled corners overcome the necessity of using

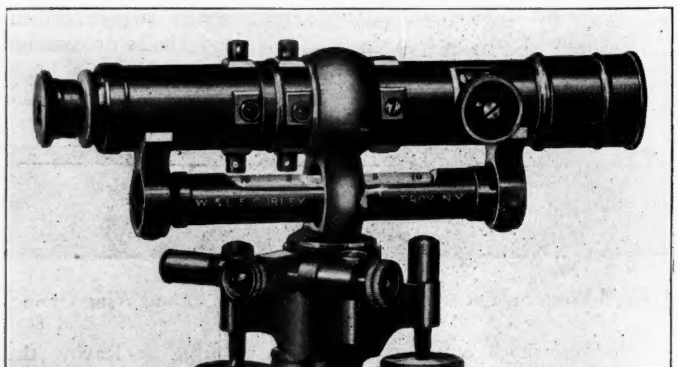


Sections of Old and New Lackawanna Corner Sections. A New Lackawanna Steel Sheet Piling Section

specially fabricated and less easily driven corners. They also weigh less per lineal foot than the fabricated corners and can be used wherever the conditions of load are not excessive. Where a variation from 90 deg. is desired, a special angle can also be rolled at slightly increased expense.

A LIGHT COMPACT LEVEL

A new model level that is small, light and compact, has recently been placed on the market by W. & L. E. Gurley, Troy, N. Y., for use in preliminary exploration where it is not convenient to use a larger instrument or where extreme refinement of observation is unnecessary. The instrument has a long spindle and socket, four leveling screws with dust caps, clamps and tangent to the spindle. The telescope is 6½ in. long with an



A Light Level for Reconnaissance Work

erecting eye piece. It has a magnifying power of 16 diameters; the aperture of the object glass is 11/16 in.; the object slide is moved by a rack and pinion and the eye piece by a spiral movement. The level has a sensitive ground vial with graduations on the glass. The instrument alone weighs 2½ lb., and with box and accessories, 5 lb. The tripod weighs from 4 to 6 lb.

General News Department

The *Sunset Magazine* has been sold by the Southern Pacific Company to William Woodhead, who had been its advertising manager. He will call it the *Pacific Monthly*.

The New York, New Haven & Hartford reports that 600 trespassers have been arrested on its right of way during the last month and that 90 per cent. of the persons arrested have been convicted in court.

An officer of the Baltimore & Ohio says that the growth of the parcel post service is compelling the railroads to widen the side doors of mail cars, in order to avoid delays to trains in loading large packages. The expense incident to this change will total a large sum.

Pursuing the campaign against trespassers, the Baltimore & Ohio has notified agents to discuss with justices of the peace and other town and county authorities, the facts pertaining to the loss of life due to trespassing. The authorities are being asked to co-operate with the railroad.

The Interstate Commerce Commission has made a conference ruling which holds that "a carrier cannot shield itself from responsibility in paying a claim by accepting the authority of a connecting line to pay it; it must ascertain the lawfulness of the claim and allow it or not, upon the basis of its investigation."

C. E. Schaff, president of the Missouri, Kansas & Texas, is quoted as estimating the damage to that company's lines as a result of the recent heavy rains at $350,000. The storm washed out considerable track and weakened many miles of roadbed. The losses on the Texas lines amount to about $100,000, and those on the lines in Oklahoma and other states $250,000.

Brakeman H. B. Jordan, of the Southern Railway at Greensboro, N. C., has been commended by his superintendent for his prompt action on the night of April 7, when he mounted a moving switch engine whose crew had been driven from the cab by a broken steam pipe and by applying the emergency brake brought the engine to a stop. The engine was moving at a speed of about 20 miles an hour and was running towards car No. 11. Had it struck the car it would have knocked it into a roomful of people.

The strike of shopmen and others on the Pennsylvania Railroad, noticed last week, appears to have gone somewhat farther than was then reported; and on May 8 it was reported that about 700 men, altogether, had left their work. None of the shopmen at Altoona went out, and it does not appear that the so-called strike has disturbed the operation of the road seriously. At Enola, near Harrisburg, the railroad company provided food and lodgings for the new workmen, in a building in the yard.

The Atchison, Topeka & Santa Fe, according to announcement made through President Ripley's office, will, through its division superintendent, give local public officials in Santa Fe territory the benefit of its knowledge and experience in matters pertaining to the construction of buildings, bridges, highways, etc., when invited to do so. President Ripley takes the position that the Santa Fe, being a heavy tax payer in every city and township traversed by its lines, is interested in all public improvements to the extent of having the best work done with the funds available.

The Department of Agriculture announces that seven railroads have been fined $3,125 for violation of the law that prohibits the confinement of live stock in cars for over 28 hours. The fines, with the addition in some instances of costs, were imposed as follows: Louisville & Nashville, $1,300; Baltimore & Ohio, $1,125; Baltimore & Ohio Southwestern, $300; Kansas City Southern, $100; Chesapeake & Ohio, $100; Union Pacific, $100; Denver & Rio Grande, $100. The Louisville & Nashville was also fined $200 and costs for violation of the live stock quarantine law, and the Galveston, Harrisburg & San Antonio $300 for three violations.

The Southern Pacific reports that the accident record of the road for March was one of the best in its history. Not a single fatality, either to a passenger or employee, occurred from the operation of trains or in industrial pursuits. The Pacific system, 6,380 miles, carried 3,079,000 passengers an aggregate distance of 102,655,000 miles in March without a single injury; and of the 43,000 employees only one was injured in an accident. The Southern Pacific has a record of having operated its entire line for five years and eight months without a fatal accident to a passenger resulting from train operation.

On the Cleveland division of the Baltimore & Ohio, the "safety first" movement has been expanded into an efficiency movement, with a gratifying degree of success; and now the superintendent, Mr. Lechlider, proposes to the employees that they go a step farther and include in their program a more intimately personal element; safety, efficiency, thrift. The Baltimore & Ohio for years has had a relief department, and in this department there is a savings bank, conducted for the benefit of all employees of the road; and it is proposed to "boost" the savings department by encouraging employees to buy for themselves homes. This department owns a house at Lorain which it will sell for $1,900; the first payment to be $100. Thereafter monthly instalments of $22.50 would be paid until the whole sum is liquidated.

On the Chicago Great Western, according to a statement made by the superintendent of telegraph, experiments have been made with the dictaphone for the purpose of conveying to the train despatcher information of the movements of trains at stations where no operator is on duty. By means of a selector, the dictaphone apparatus, at the station, is connected to or disconnected from the telephone line at will; and, with the instrument connected, the despatcher, 57 miles away, heard the ringing of the engine bell, the exhaust of the engine and the roar of a train passing the station, with all desirable distinctness. Other noises around the station were also heard. The despatcher recorded the arrival and departure of a passenger train, identifying it by the noise of loading milk cans; and subsequently he corrected the agent when he made a mistake of two or three minutes in reporting the time of that train.

The arbitrators chosen to settle the wages of the enginemen and firemen of the Georgia & Florida issued their report on May 9, granting a substantial increase in wages. The rate for passenger enginemen is 3.4 cents a mile, with overtime at 50 cents an hour; freight trains 4.15 cents a mile; local freight, 4.95; work trains, 12 hours, $4.15, with overtime at 40 cents an hour. In switching service the rate is $3.50 for ten hours or less, exclusive of meal hours; overtime 35 cents an hour. The rates for firemen are 50 per cent. of the rates awarded to the enginemen. Mr. Anderson, the arbitrator appointed on behalf of the road, dissented from the decision, holding that the majority were wrong in disregarding the plea of the road that its earnings were small and that the work and responsibility of the enginemen were less exacting than on other roads. The third or independent arbitrator was Judge Stanton J. Peele.

Trainmen Should Study the Accident Records and Pull Together*

The last report of the Interstate Commerce Commission on accidents is a terrible arraignment of us—and this, coupled with the flood of newspaper condemnation and criticism and the distorted brain-storming of the muckraker has put us in bad.

Are we guilty or are we the scapegoat? But it matters not which, the fact remains that we are coming before the public as a class of people who prefer to be careless than otherwise—who don't go to church and who vote the straight wet ticket every time. Now we know, amongst ourselves, that this is not true, but it is up to us to demonstrate by our conduct that it is not.

The reports of the Interstate Commerce Commission are very

*Extracts from an article by Henry Driscoll in the Chicago, Milwaukee & St. Paul Employees' Magazine.

generally unknown; from a personal canvass I am safe in saying that 90 per cent. of us know very little of any public document, and therefore, I wish to talk now of the I. C. C. report for the year ending June 30, 1913.

Read some extracts from that report. . . .

We may interpret the report as saying that the commission will admit we possess brains enough to understand the rules but lack sufficient common sense to realize the terrible consequences of their violation.

This is a sad commentary upon a body of men who believe they possess not only a thorough knowledge of the rules but also realize the consequence of their violation.

I have worked as a conductor on five transcontinental railroads, and I desire to see all railroad employees make a combined attack upon the element of danger which surrounds our occupation. Personally I am enthusiastic over the latent possibilities in this movement.

In joining the safety first movement, you place yourself under no obligation other than a manly promise to live up to the golden rule and observe the first law of nature, and the foremost rule of railroading. Let all railroad men who feel the humiliation of the I. C. C. report call upon the careless and the reckless, to get right with the American public.

The nicely veiled suggestions in the report, in regard to the necessity of greater supervision and closer inspection, will not be overlooked; the public will demand it and the government will compel it. Here is a hint of government supervision.

Any railroad man who wants that kind of supervision, just continue in the old way and build up another report like the last few of the I. C. C. and we shall have a new face in the crew, and his button will spell U. S. Inspector.

In such a large body of men it is a difficult matter to exclude the drone—the careless, shiftless individual, who worms his way into a position of responsibility. It is because of the presence of such in our ranks that the I. C. C. has placed us before the public in such a compromising position.

Safety first proposes to apply a remedy to this element. The old experienced engineer has been obliged to watch from the cab of his engine the wild antics of a youthful train crew, batting them out and catching them on the fly, until somebody telephoned for the ambulance. For him to have counseled or advised them in a safer and saner way of working, or for the old, experienced conductor to criticize the actions of the younger man, would be followed by abuse.

The student question is a problem for safety first to handle. Let us approach this matter without prejudice and by wise counsel and good example educate the beginner to a serious understanding of the position he holds. There is within the body another element, the stumbling block in the pathway of progress, the pessimist; the man with the perpetual grievance against anybody and everybody, continually trying to syndicate his troubles. It will be the unpleasant duty of Safety First to lift this gentleman up out of the slough of despond and land him so far off the right-o'-way that his noise will not disturb those of us who cannot coincide with his pet theories.

There has got to be a decided decrease in fatalities and the Interstate Commerce Commission report will be the barometer of our success or failure to control the situation.

Air Brake Story Contest

A. L. Humphrey, vice-president and general manager of the Westinghouse Air Brake Company, has announced a competition for an air brake story, which is open to railway employees. Following are the conditions of this contest:

For the best true stories illustrating the value of the Westinghouse air brake, in terms of performance and capacity, as determined by an independent committee of judges, we will make the following awards in cash:

First prize story	$1,000
Second prize story	500
Third prize story	200
Fourth prize story	150
Fifth prize story	100
Sixth prize story	50

"The purpose we have in mind is to draw from the experience and practical knowledge of railroad officers and employees, striking stories of air brake performance. We know that the history of the art of braking railroad trains is rich in dramatic, but as yet unwritten narrative. On the one hand is a vast amount of such material as spectacular escape from wreck or disaster; and on the other hand a still larger—and largely unexplored—field covering the concrete evidences that efficient train control is the supreme factor in the ability to handle heavier freight and passenger traffic; and that increased tonnage, longer trains, higher speeds, etc., are simply visible demonstrations of the controlling influence of the air brake as expressed in the larger earning power possible from operation.

"Each 'story' must be written either from the practical experiences or personal observations of the writer or from information obtained at first hand from railroad men who actually know the facts. Each contestant may choose his own individual style of expression, use railroad dialect if desired, and illustrations if thought advisable. Correct names, dates, places and persons should be used so far as possible, but fictitious substitutes may be employed provided this is so stated in the transmitting letter and the fundamental facts related have actually occurred. There is no limitation as to the time when the facts given in the story may have occurred, but naturally these facts will be of larger interest if covering recent years and particularly if they apply to present standard forms of Westinghouse brake equipment. The stories will be judged primarily upon the convincing character of the narrative as to the value of the air brake; originality; striking or unusual features; accuracy of facts given; relation of the story to present day conditions; concise expression; and brevity.

"The contest is open to bona fide employees of any railroad in the United States, operating regular traffic schedules, without limitation of any kind as to age, character of work, education, or other qualification.

"No 'story' shall be more than two thousand words in length. Manuscripts exceeding two thousand words will not be considered in the competition. Each 'story' should be written on one side of the sheet only and preferably typewritten. Neither name, address, nor other means of identification should be shown except in the transmitting letter.

"No expense is involved in entering this contest, but it is understood that all narratives submitted become the property of the Westinghouse Air Brake Company whether securing an award or otherwise.

"Decision as to merits of the stories submitted will be placed absolutely in the hands of a committee of judges composed of three prominent persons not associated in any way with the Westinghouse interests.

"Each 'story' should be addressed to the 'Judges of Prize Contest,' room 2121, 165 Broadway, New York, N. Y. When received and serially numbered, the manuscripts, without name or other identification, will be turned over to the committee of judges by a disinterested party appointed by and acting for the committee, and who will retain the transmitting letters after making careful record thereon of the serial number of the manuscript. The judges will, therefore, pass upon the manuscript submitted without knowing by whom written until after the award is made.

"All stories to be considered in this competition must be in the hands of the committee on or before August 1, 1914. Announcement of awards by the committee of judges will be made as promptly as possible thereafter."

Penalty for Running Special Train to a Lynching

In the Federal Court at Jackson, Miss., on May 8, a compromise decree was handed down under which the Vicksburg, Shreveport & Pacific is to pay $7,000 to Mrs. Alice Rogers in connection with the lynching of her husband by a mob at Tallulah, La., some years ago, after he had been acquitted by the court of a charge of murder. The mob got the road to run a special train to carry them from Monroe to Tallulah, about 50 miles. For permitting the use of its train for this purpose the road is now held liable.

Association of Railroad Chief Surgeons

The annual meeting of the Association of Railroad Chief Surgeons was held in Chicago on May 4, with an attendance comprising over half of the chief surgeons of the railways of the United States and Canada. The program consisted of a list of topics for discussion, including the following: The Furnishing of Transportation to Surgeons, The Interchange of

Surgeons at Junction Points, The Value of the Safety First Movement, The Desirability of Uniformity of State Laws Regarding Transportation of the Dead, Regulations in Regard to Handling Water and Ice on Passenger Trains with Consideration of Required Certification, Contract Practice as Pertaining to Railroad Surgeons, and Theoretical versus Field Examinations of Color Vision. Officers were elected as follows: President, Dr. James A. Denney, medical director, Chicago, Burlington & Quincy, Chicago; vice-president, John H. Rishmiller, chief surgeon, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis; and secretary and treasurer, Louis J. Mitchell, Chicago. The semi-annual meeting of the association will be held at Chicago on October 13.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.

American Association of Demurrage Officers.—A. G. Thomason, Boston, Mass.

American Association of General Passenger and Ticket Agents.—W. C. Hope, 143 Liberty St., New York.

American Association of Freight Agents.—R. O. Wells, I. C. R. R., East St. Louis, Ill.

American Association of Railroad Superintendents.—E. H. Harman, St. Louis, Mo.; 3d Thursday and Friday in May.

American Electric Railway Association.—E. B. Burritt, 29 W. 39th St., New York. Annual convention, October 12-16, Atlantic City, N. J.

American Electric Railway Manufacturers' Assoc.—H. G. McConnaughy, 165 Broadway, New York. Meetings with Am. Elec. Ry. Assoc.

American Railway Association.—W. F. Allen, 75 Church St., New York. Next meeting, May 20, Hotel Biltmore, 43d St., New York.

American Railway Bridge and Building Association.—C. A. Lichty, C. & N. W., Chicago. Next convention, October 20-22, 1914, Los Angeles, Cal.

American Railway Engineering Association.—E. H. Fritch, 900 S. Michigan Ave., Chicago. Next convention, March 16-18, 1915.

American Railway Master Mechanics' Association.—J. W. Taylor, Karpen Building, Chicago. June 15-17, Atlantic City, N. J.

American Railway Tool Foremen's Association.—A. R. Davis, Central of Georgia, Macon, Ga. Next convention, July 20-22, Hotel Sherman, Chicago.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa. Next annual meeting, June 30 to July 4, Hotel Traymore, Atlantic City, N. J.

American Society of Civil Engineers.—Chas. W. Hunt, 220 West 57th St., New York; 1st and 3d Wed., except June, July and August, New York. Annual convention, June 2-5, Baltimore, Md.

American Society of Engineering Contractors.—J. R. Wemlinger, 11 Broadway, New York; 2d Thursday of each month, at 2 P. M., 11 Broadway, New York.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York. June 16-19, St. Paul-Minneapolis, Minn.

American Wood Preservers' Association.—F. J. Angier, B. & O., Baltimore, Md. Next convention, January 19-21, 1915, Chicago.

Association of American Railway Accounting Officers.—C. G. Phillips, Highland Park, Ill. Annual meeting, June 24, Minneapolis, Minn.

Association of Railway Claim Agents.—C. W. Egan, B. & O., Baltimore, Md. Next convention, May, St. Paul, Minn.

Association of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago. Semi-annual meeting, June 12, Hotel Denis, Atlantic City, N. J. Annual convention, October 19-23, Chicago.

Association of Railway Telegraph Superintendents.—P. W. Drew, 112 West Adams St., Chicago. Next convention, May 19-22, New Orleans, La.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 75 Church St., New York. Annual meeting, Hotel Chalfont, Atlantic City, N. J., June 18-19.

Association of Water Line Accounting Officers.—W. R. Evans, Chamber of Commerce, Buffalo, N. Y.

Bridge and Building Supply Men's Association.—L. D. Mitchell, Detroit Graphite Co., Chicago, Ill. Meeting with American Railway Bridge and Building Association.

Canadian Railway Club.—James Powell, Grand Trunk Ry., Montreal, Que.; 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal.

Canadian Society of Civil Engineers.—Clement H. McLeod, 176 Mansfield St., Montreal, Que.; 1st Thursday, October, November, December, February, March and April, Montreal.

Car Foremen's Association of Chicago.—Aaron Kline, 841 Lawler Ave., Chicago; 2d Monday in month, except July and August, Lytton Bldg., Chicago.

Central Railway Club.—H. D. Vought, 95 Liberty St., New York; 2d Fri. in Jan., May, Sept. and Nov. and 2d Thurs. in March, Hotel Statler, Buffalo, N. Y.

Civil Engineers' Society of St. Paul.—Edw. J. Dugan, P. O. Box 654, St. Paul, Minn.; 2d Monday, except June, July, August and September, Old State Capitol Bldg., St. Paul.

Engineers' Society of Pennsylvania.—Edw. R. Dasher, Box 75, Harrisburg, Pa.; 1st Friday after 10th of each month, except July and August, 31 So. Front St., Harrisburg, Pa.

Engineers' Society of Western Pennsylvania.—Elmer K. Hiles, Oliver Bldg., Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

Freight Claim Association.—Warren P. Taylor, Richmond, Va. Next convention, May 13, Hotel Galvez, Galveston, Tex.

General Superintendents' Association of Chicago.—A. M. Hunter, 605 Grand Central Station, Chicago; Wed. preceding 3d Thurs., Transportation Bldg., Chicago.

International Railway Congress.—Executive Committee, 11, rue de Louvain, Brussels, Belgium. Convention, 1915, Berlin.

International Railway Fuel Association.—C. G. Hall, 922 McCormick Bldg., Chicago. Annual convention, May 18-21, Hotel La Salle, Chicago.

International Railway General Foremen's Association.—Wm. Hall, 829 West Broadway, Winona, Minn. Next convention, July 14-17, Hotel Sherman, Chicago.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio. Next convention, third Tuesday in August.

Maintenance of Way Master Painters' Association of the United States and Canada.—T. I. Goodwin, C. R. I. & P., Eldon, Mo. Next convention, November 17-19, 1914, Detroit, Mich.

Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York. Next annual meeting, May 25-28, Hotel Walton, Philadelphia.

Master Car Builders' Association.—J. W. Taylor, Karpen Building, Chicago. June 10-12, Atlantic City, N. J.

Master Car & Locomotive Painters' Assoc. of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass. Next convention, September 8-11, Nashville, Tenn.

National Railway Appliances Association.—Bruce V. Crandall, 537 So. Dearborn St., Chicago. Next convention, March 15 to 19, 1915, Chicago.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.

New York Railroad Club.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.

Niagara Frontier Car Men's Association.—E. Frankenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings monthly.

Peoria Association of Railroad Officers.—M. W. Rotchford, Union Station, Peoria, Ill.; 2d Thursday in month, Jefferson Hotel, Peoria.

Railroad Club of Kansas City.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.

Railroad Master Tinners, Coppersmiths & Pipefitters' Association.—U. G. Thompson, C. & E. I., Danville, Ill. Annual meeting, May 19-22, Marquette Hotel, St. Louis, Mo.

Railway Business Association.—Frank W. Noxon, 30 Church St., New York.

Railway Club of Pittsburgh.—J. B. Anderson, Penna. R. R., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.

Railway Development Association.—W. Nicholson, Kansas City Southern, Kansas City, Mo.

Railway Electrical Supply Manufacturers' Assoc.—J. Scribner, 1021 Monadnock Block, Chicago. Meetings with Assoc. Ry. Elec. Engrs.

Railway Fire Protection Association.—C. B. Edwards, Mobile & Ohio, Mobile, Ala. Annual meeting, 1st Tuesday in October.

Railway Gardening Association.—J. S. Butterfield, Lee's Summit, Mo.

Railway Signal Association.—C. C. Rosenberg, Bethlehem, Pa. New York, May 27 and 28. Annual meeting, Bluff Point, N. Y., September 22-24.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio. Next convention, May 18-20, Hotel Raleigh, Washington, D. C.

Railway Supply Manufacturers' Association.—J. D. Conway, 2136 Oliver Bldg., Pittsburgh, Pa. Meetings with M. C. B. and M. M. Associations. Atlantic City, June 10 to 17.

Railway Telegraph & Telephone Appliance Association.—G. A. Nelson, 50 Church St., New York. Meetings with Assoc. of Ry. Teleg. Supts.

Richmond Railroad Club.—F. O. Robinson, C. & O., Richmond, Va.; 2d Monday in month, except June, July and August.

Roadmasters' and Maintenance of Way Association.—L. C. Ryan, C. & N. W., Sterling, Ill. Next convention, September 8-10, 1914, Chicago.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.

Salt Lake City Transportation Club.—R. E. Rowland, Hotel Utah Bldg., Salt Lake City, Utah; 1st Saturday of each month, Salt Lake City.

Signal Appliance Association.—F. W. Edmunds, 3868 Park Ave., New York. Meeting with annual convention Railway Signal Association.

Society of Railway Financial Officers.—Carl Nyquist, La Salle St. Station, Chicago.

Southern Association of Car Service Officers.—E. W. Sandwich, A. & W. P. Ry., Atlanta, Ga. Next meeting, July 16, Chattanooga, Tenn.

Southern & Southwestern Railway Club.—A. J. Merrill, Grant Bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., 10 A. M., Candler Bldg., Atlanta.

Toledo Transportation Club.—J. S. Marks, Agent, Interstate Despatch, Toledo, Ohio; 1st Saturday in month, Boody House, Toledo.

Track Supply Association.—W. C. Kidd, Ramapo Iron Works, Hillsburn, N. Y. Meetings with Roadmasters' and Maintenance of Way Association.

Traffic Club of Chicago.—W. H. Wharton, La Salle Hotel, Chicago.

Traffic Club of New York.—C. A. Swope, 291 Broadway, New York; last Tuesday in month, except June, July and August, Waldorf-Astoria, New York.

Traffic Club of Pittsburgh.—D. L. Wells, Erie R. R., Pittsburgh, Pa.; meetings bimonthly, Pittsburgh. Annual meeting, 2d Monday in June.

Traffic Club of St. Louis.—A. F. Versen, Mercantile Library Building, St. Louis, Mo. Annual meeting in November. Noonday meetings October to May.

Train Despatchers' Association of America.—J. F. Mackie, 7122 Stewart Ave., Chicago. Next convention, June 16, Jacksonville, Fla.

Transportation Club of Buffalo.—J. M. Sells, Buffalo; first Saturday after first Wednesday.

Transportation Club of Detroit.—W. R. Hurley, Supt.'s office, L. S. & M. S., Detroit, Mich.; meetings monthly, Normandie Hotel, Detroit.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Next meeting, August, Chicago.

Utah Society of Engineers.—Frank W. Moore, Newhouse Bldg., Salt Lake City, Utah; 3d Friday of each month, except July and August, Consolidated Music Hall, Salt Lake City.

Western Canada Railway Club.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.

Western Railway Club.—J. W. Taylor, 1112 Karpen Building, Chicago; 3d Tuesday of each month, except June, July and August, Karpen Building, Chicago.

Western Society of Engineers.—J. H. Warder, 1735 Monadnock Block, Chicago; regular meeting 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings.

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MARCH, 1914

Name of road.	Average mileage operated during period.	Operating revenues—Freight.	Operating revenues—Passenger.	Operating revenues—Total. inc. misc.	Operating expenses—Maintenance—Way and structures.	Operating expenses—Maintenance—Of equipment.	Operating expenses—Traffic.	Operating expenses—Transportation.	Operating expenses—General.	Operating expenses—Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Alabama & Vicksburg	143	$97,816	$34,205	$142,415	$25,593	$42,926	$4,139	$56,640	$6,596	$135,894	$6,521	—$313	$7,250	—$1,042	—$35,312
Alabama Great Southern	309	307,754	90,212	432,023	55,418	108,071	12,911	164,115	12,451	352,966	79,057	—794	15,493	62,770	—22,006
Ann Arbor	292	124,622	34,315	171,597	17,618	25,835	5,097	69,132	7,788	125,470	46,127	23	13,770	32,380	—540
Arizona Eastern	367	203,727	35,179	248,727	45,433	27,154	1,927	64,163	10,531	149,208	99,519	218	12,260	87,477	—3,012
Arizona & New Mexico	109	77,560	9,089	89,818	12,853	13,029	783	15,176	3,564	45,405	44,413	....	3,000	41,413	1,183
Atchison, Topeka & Santa Fe	8,340	5,261,925	1,914,326	8,007,213	899,175	1,294,907	183,539	2,275,353	174,830	4,827,804	3,179,409	....	389,555	2,789,854	252,368
Atlanta & West Point	93	60,382	37,262	108,301	15,981	22,365	4,748	33,818	4,370	81,282	27,019	140	7,125	20,034	—7,274
Atlanta, Birmingham & Atlantic	646	229,994	47,743	304,538	43,469	48,759	13,800	121,251	11,617	238,896	65,642	....	14,337	51,305	—9,691
Atlantic & St. Lawrence	167	125,462	19,561	158,804	12,475	22,585	4,646	73,990	4,541	118,237	40,567	....	10,157	30,410	—21,403
Atlantic City	167	64,892	50,244	121,947	30,881	16,932	2,136	78,135	1,415	129,499	—7,552	—3,025	15,000	—25,577	—14,018
Atlantic Coast Line	4,680	2,599,456	915,275	3,763,661	444,134	544,084	56,941	1,234,825	113,572	2,393,556	1,370,105	—1,033	132,000	1,237,072	—157,113
Baltimore & Ohio—System	4,456	6,454,986	1,085,898	7,974,380	695,406	1,255,332	163,779	3,291,377	194,250	5,600,144	2,374,236	—47,559	283,806	2,042,871	867,710
Baltimore & Ohio Chicago Terminal	77	....	567	119,926	9,036	29,012	722	58,737	4,381	101,888	18,038	706	19,021	—277	—7,595
Bangor & Aroostook	631	362,889	52,220	428,429	32,118	42,569	2,483	129,576	10,267	217,013	211,416	—7	8,789	202,620	129,995
Belt Ry. Co. of Chicago	21	....	....	285,693	13,198	32,596	922	108,193	6,013	160,922	124,771	....	9,513	115,258	28,665
Bessemer & Lake Erie	204	313,357	24,896	348,093	58,166	225,560	10,176	150,209	13,492	457,603	—109,510	....	18,000	—127,510	—204,043
Bingham & Garfield	27	162,983	4,681	168,443	9,388	15,684	757	24,186	2,140	52,155	116,288	....	3,185	113,103	59,487
Birmingham Southern	44	54,881	1,086	94,361	13,999	20,486	446	33,715	4,187	72,833	21,528	....	1,614	19,914	—26,547
Boston & Maine	2,252	2,322,487	1,118,376	3,727,975	381,529	654,732	47,486	1,968,820	122,888	3,175,455	552,520	13,087	177,907	387,700	214,351
Buffalo & Susquehanna Railroad Corp.	253	142,298	6,520	152,584	23,147	38,212	1,470	57,195	6,870	126,894	25,690	....	2,600	23,090	....
Buffalo & Susquehanna Railway	91	38,053	5,038	45,412	6,873	11,504	487	18,340	2,190	39,394	6,018	—5	1,600	4,413	21,193
Buffalo, Rochester & Pittsburgh	586	797,921	79,893	901,590	79,415	196,541	13,471	377,909	19,775	687,111	214,479	—425	18,000	196,054	—20,124
Butte, Anaconda & Pacific	91	106,669	10,329	127,859	11,509	23,873	521	40,988	5,222	82,113	45,746	....	2,500	43,246	21,230
Canadian Pacific Lines in Maine	233	143,355	41,039	197,828	38,059	29,363	6,725	85,641	4,709	164,497	33,331	....	11,000	22,331	—44,400
Carolina, Clinchfield & Ohio	248	169,868	13,386	186,930	10,893	27,216	6,515	37,349	9,133	91,106	95,824	....	14,250	81,574	—15,950
Carolina, Clinchfield & Ohio of S. C.	18	12,814	1,428	14,562	825	90	1,527	2,593	660	5,695	8,867	....	750	8,117	180
Central of Georgia	1,924	952,310	270,557	1,325,377	171,240	234,843	35,628	448,268	41,714	931,693	393,684	4,826	52,365	346,145	—26,447
Central of New Jersey	676	1,798,619	364,087	2,233,544	272,920	410,037	29,132	801,774	47,568	1,561,431	672,113	—39,145	111,822	521,146	—50,673
Central New England	304	248,030	34,069	298,106	38,008	43,835	1,241	116,431	6,027	205,542	92,564	—86	11,500	80,978	—51,593
Central Vermont	411	250,102	62,787	334,339	22,889	53,406	7,979	177,332	7,863	269,469	64,870	27	16,980	47,917	16,491
Charleston & Western Carolina	341	178,998	28,674	216,450	31,960	39,973	3,923	76,960	5,546	158,362	58,088	....	5,000	53,088	1,123
Chesapeake & Ohio Lines	2,347	2,607,280	432,422	3,151,635	270,576	686,826	51,455	1,083,655	72,656	2,165,168	986,467	3,730	120,671	869,526	220,240
Chicago & Alton	1,026	707,202	290,914	1,097,543	137,130	313,866	46,068	458,970	36,438	992,472	105,071	—3,507	55,200	46,364	53,967
Chicago & Eastern Illinois	1,282	1,129,695	224,677	1,441,036	119,737	373,076	22,283	552,867	38,522	1,106,485	334,551	—1,313	56,900	276,338	75,876
Chicago & Erie	270	433,401	50,220	522,934	60,525	135,975	22,650	271,914	11,712	502,776	20,158	—734	16,033	3,391	66,983
Chicago & North Western	8,095	4,698,675	1,556,510	6,844,471	593,800	992,199	109,548	2,693,397	143,564	4,532,508	2,311,963	4,398	385,000	1,931,361	476,206
Chicago, Burlington & Quincy	9,129	5,520,288	1,508,923	7,626,213	607,225	1,362,492	135,676	2,638,397	204,276	4,948,066	2,678,147	—22,836	304,327	2,350,984	766,260
Chicago Great Western	1,496	903,035	235,698	1,231,656	96,659	223,737	47,983	488,152	38,238	894,769	336,887	—1,558	46,107	289,222	39,039
Chicago, Indiana & Southern	359	390,115	21,948	423,881	39,447	114,476	8,707	141,908	9,033	313,571	110,310	—67	18,510	91,733	14,324
Chicago, Indianapolis & Louisville	617	412,529	129,459	592,293	81,903	103,922	20,281	228,323	17,508	451,937	140,356	....	32,079	108,277	83,477
Chicago Junction	12	....	....	172,515	10,335	16,108	1,032	90,624	4,509	122,608	49,907	8,840	2,033	56,714	13,081
Chicago, Milwaukee & St. Paul	9,690	5,669,487	1,378,863	7,630,103	514,836	958,368	123,531	2,766,184	137,809	4,500,728	3,129,375	8,019	354,228	2,783,166	652,646
Chicago, Peoria & St. Louis	255	120,256	22,661	151,390	20,534	31,300	5,997	73,501	5,049	136,381	15,009	....	8,000	7,009	10,244
Chicago, Rock Island & Gulf	477	140,527	44,085	202,483	30,676	22,217	9,371	101,820	7,579	171,663	30,820	—585	8,815	21,420	—58,984
Chicago, Rock Island & Pacific	7,845	3,806,775	1,286,329	5,434,472	541,512	742,051	141,007	2,364,741	152,900	3,942,211	1,492,261	—15,963	223,848	1,252,450	360,688
Chicago, St. Paul, Minneapolis & Omaha	1,747	1,035,368	373,441	1,496,113	129,655	210,188	31,383	628,693	38,101	1,038,020	458,093	—244	86,372	371,477	88,413
Chicago, Terre Haute & Southeastern	362	219,909	15,169	239,175	17,458	57,309	3,428	66,683	9,290	154,168	85,007	—37	11,500	73,470	63,179
Cincinnati, Hamilton & Dayton	1,015	602,131	104,080	784,484	162,407	146,264	20,581	413,525	20,741	763,518	20,966	....	36,167	—15,201	10,870
Cincinnati, New Orleans & Texas Pacific	337	692,870	183,504	919,965	85,339	228,164	25,090	299,418	24,501	662,512	257,453	292	31,000	226,745	14,224
Cincinnati Northern	245	94,733	16,134	115,644	16,117	26,922	2,773	60,749	3,671	110,232	5,412	....	6,000	—588	10,256
Cleveland, Cincinnati, Chic. & St. Louis	2,361	2,145,986	632,484	3,028,158	441,435	718,967	66,613	1,394,477	66,979	2,688,471	339,687	—6,421	124,500	208,766	—177,572
Colorado Midland	338	100,464	15,295	124,257	16,237	36,472	6,761	60,702	5,581	125,753	—1,496	—200	10,000	—11,696	1,296
Colorado & Southern	1,127	452,117	89,474	583,958	68,835	88,351	10,247	221,467	21,109	410,009	173,949	—178	35,625	138,146	—30,766
Cumberland Valley	162	203,882	47,042	262,413	31,587	34,121	4,293	109,176	9,313	188,490	73,923	9	5,910	68,022	—18,176
Delaware & Hudson Co.—R. R. Dept.	880	1,336,327	193,204	1,600,621	151,632	312,567	25,627	755,981	70,193	1,316,000	284,621	1,817	55,950	230,488	—370,056
Delaware, Lackawanna & Western	960	2,002,947	571,496	2,777,930	408,374	539,940	68,916	1,080,079	78,062	2,175,371	602,559	33,694	185,000	451,253	—150,132
Denver & Rio Grande	2,574	1,313,915	289,582	1,680,465	209,670	342,209	39,274	536,178	51,745	1,179,076	501,389	—4,751	70,000	426,638	42,289
Denver & Salt Lake	255	65,726	11,967	81,138	16,393	19,429	933	36,947	5,371	79,073	2,065	....	4,500	—2,435	8,243
Detroit & Mackinac	411	86,763	25,140	118,545	10,209	18,498	2,385	40,542	2,854	74,488	44,057	—73	9,157	34,827	—2,316
Detroit & Toledo Shore Line	79	153,844	....	153,963	12,503	12,941	1,681	45,408	2,652	75,185	78,778	....	4,703	74,075	21,856
Detroit, Grand Haven & Milwaukee	191	132,000	41,000	195,258	14,707	40,942	7,215	130,523	5,274	198,661	—3,403	73	3,600	—6,930	4,352
† Detroit River Tunnel	...	....	....	....	....	....	....	....	....	....	....	....	....	....	....

† Included in Michigan Central beginning January 1, 1914.

REVENUES AND EXPENSES OF RAILWAYS

Month of March, 1914—Continued

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Passenger.	Total. inc. misc.	Operating expenses: Maintenance: Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Detroit, Toledo & Ironton	441	$124,195	$8,977	$144,194	$2,194	$20,712	$2,472	$69,949	$5,809	$101,136	$43,058	....	$5,700	$37,358	$62,946
Duluth & Iron Range	292	94,608	24,469	127,623	41,319	55,403	895	75,098	9,443	182,158	—54,535	—$12,830	6,371	—73,736	—3,833
Duluth, Missabe & Northern	363	85,313	31,152	121,277	125,123	81,860	2,167	84,241	13,925	307,316	—186,039	—2,270	6,162	—194,471	—75,519
Duluth, South Shore & Atlantic	627	199,201	67,469	280,144	36,514	34,937	7,567	111,634	9,544	200,196	79,948	—1,325	19,600	59,023	39,809
Duluth, Winnipeg & Pacific	181	132,212	21,759	156,307	16,802	34,633	1,567	59,384	5,777	118,163	38,144	....	7,815	30,329	—26,119
El Paso & Southwestern Co	1,030	654,567	100,193	785,996	84,356	110,603	21,096	221,369	26,736	464,160	321,836	840	38,211	284,465	29,425
Elgin, Joliet & Eastern	774	965,782	3	1,019,606	102,904	219,090	5,906	301,308	19,031	648,239	371,367	....	46,815	324,552	—88,323
Erie	1,988	3,264,756	669,606	4,261,159	349,226	942,468	98,630	1,615,828	109,235	3,115,387	1,145,772	—47,567	164,424	933,781	—227,109
Florence & Cripple Creek	87	79,633	11,722	93,229	5,542	8,007	1,772	33,323	5,390	54,034	39,195	....	9,589	29,606	—8,863
Florida East Coast	696	282,383	346,896	711,196	62,862	61,968	7,295	178,907	10,938	321,970	389,136	—216	20,000	368,920	25,791
Fort Worth & Denver City	454	235,522	92,522	349,263	36,064	52,944	5,223	178,076	15,948	288,255	61,008	—756	13,300	46,952	16,138
Galveston, Harrisburg & San Antonio	1,338	647,848	256,741	966,208	139,133	183,060	34,962	459,444	35,529	852,128	114,080	—1,671	45,650	66,759	—30,978
Georgia	307	212,338	66,865	297,307	28,811	49,137	11,558	122,001	8,826	220,333	76,973	....	2,350	74,623	10,705
Georgia, Southern & Florida	395	131,528	61,060	218,667	23,036	45,554	9,396	95,789	10,320	184,095	34,572	—203	11,227	23,142	—31,091
Grand Rapids & Indiana	576	306,135	117,127	453,358	56,232	78,669	11,207	206,930	15,382	368,420	84,938	—784	24,221	59,933	21,870
Grand Trunk Western	347	436,000	137,000	614,639	43,595	120,233	22,541	312,307	20,154	518,830	95,809	—1,503	31,500	62,806	—28,060
Great Northern	7,804	3,825,205	1,042,754	5,279,321	753,034	860,756	106,646	1,693,355	118,907	3,532,698	1,746,623	1,110	359,148	1,388,585	59,393
Gulf & Ship Island	308	129,063	27,005	165,733	26,089	37,457	3,327	48,884	9,202	124,959	40,774	—17	7,304	33,453	—28,462
Gulf, Colorado & Santa Fe	1,596	676,975	208,810	949,772	128,751	163,878	25,283	428,565	38,605	785,082	164,690	....	41,317	123,373	35,042
Hocking Valley	352	502,391	62,100	597,409	43,662	163,377	8,378	192,642	14,370	422,429	174,980	....	38,400	136,580	66,540
Houston, East & West Texas	191	92,503	29,764	128,686	23,078	13,050	1,577	57,865	3,992	99,562	29,124	....	4,916	24,208	—16,316
Houston & Texas Central	789	308,275	116,144	463,495	100,382	81,366	13,441	234,369	18,175	447,733	15,762	—148	27,612	—11,998	—70,518
Illinois Central	4,763	4,075,755	1,048,828	5,881,764	669,504	1,192,520	112,924	2,135,427	145,317	4,255,692	1,626,072	4,547	300,156	1,330,463	425,980
Indiana Harbor Belt	105	....	....	320,243	20,774	28,122	3,216	144,106	8,223	204,441	115,802	234	6,000	110,036	62,530
International & Great Northern	1,160	510,061	156,638	721,507	134,876	92,557	30,760	380,417	34,786	673,396	48,111	—1,589	35,000	11,522	—65,223
Kanawha & Michigan	177	235,243	25,965	266,912	36,328	56,327	3,295	79,444	7,209	182,603	84,309	—13	11,245	73,051	22,130
Kansas City Southern	827	765,833	122,246	980,970	113,638	116,194	26,054	340,322	37,761	633,969	347,001	....	46,654	300,347	44,590
Lake Erie & Western	906	415,301	61,466	503,562	61,328	101,204	12,567	206,672	11,773	393,544	110,018	....	22,000	88,018	34,750
Lake Shore & Michigan Southern	1,854	2,918,650	917,723	4,338,642	414,752	874,475	70,785	1,581,883	103,800	3,045,695	1,292,947	—5,037	196,500	1,091,410	—129,246
Lehigh & Hudson River	97	132,574	3,312	141,962	14,225	21,679	1,337	59,892	4,135	101,268	40,694	....	4,000	36,694	—2,975
Lehigh & New England	286	206,829	1,089	217,677	31,849	28,434	2,327	60,748	4,099	127,457	90,220	....	2,863	87,357	39,416
Lehigh Valley	1,440	2,584,891	302,513	3,000,131	362,803	580,260	74,871	1,219,088	107,003	2,344,025	656,106	—36,381	137,000	482,725	—61,404
Long Island	398	293,006	478,564	855,160	129,532	111,787	9,880	446,469	30,526	728,194	126,966	279	64,080	63,165	11,375
Louisiana & Arkansas	279	122,773	20,314	147,967	27,240	24,356	2,663	38,457	5,451	98,167	49,800	....	7,084	42,716	—24,813
Louisiana Ry. & Navigation	351	121,299	20,294	150,120	30,142	21,629	5,933	72,339	6,556	136,599	13,521	....	7,250	6,271	—14,334
Louisiana Western	208	143,053	60,472	212,832	21,510	43,198	7,585	67,235	6,744	146,272	66,560	—3,461	9,535	53,564	1,843
Louisville & Nashville	4,923	3,729,409	994,041	5,023,075	728,106	1,000,653	115,003	1,704,230	90,436	3,638,428	1,384,647	10,368	225,251	1,169,764	260,243
Louisville, Henderson & St. Louis	200	75,465	28,869	111,130	24,895	16,134	5,116	41,927	3,517	91,589	19,541	189	3,600	16,130	5,616
Maine Central	1,207	751,763	242,592	1,047,977	84,070	143,714	11,113	419,689	32,997	691,583	356,394	—4,521	52,130	299,743	72,481
Michigan Central	1,800	1,973,394	626,212	2,846,014	299,617	419,756	60,036	1,291,760	71,114	2,142,283	703,731	—8,335	132,000	563,396	—42,704
Midland Valley	373	73,244	38,063	120,119	30,738	26,599	2,196	44,060	5,752	109,345	10,774	—55	6,544	4,175	4,071
Minneapolis & St. Louis	1,586	660,727	143,113	845,975	84,010	126,738	21,597	336,245	19,694	588,284	257,691	—32	32,149	225,510	25,266
Minneapolis, St. Paul & S. S. Marie	3,979	1,769,300	432,363	2,337,364	196,493	342,746	55,695	826,405	58,377	1,479,716	857,648	—460	90,503	766,685	—171,222
Missouri & North Arkansas	365	71,831	30,536	109,588	29,097	25,816	4,207	47,190	5,879	112,189	—2,601	....	5,500	—8,101	—3,989
Missouri, Kansas & Texas System	3,817	1,558,588	629,421	2,369,211	325,793	291,097	58,770	1,063,077	102,665	1,841,402	527,809	—8,592	120,874	398,343	—52,325
Missouri, Oklahoma & Gulf	332	74,322	18,583	97,090	31,760	14,397	4,655	56,527	5,608	112,947	—15,857	293	6,462	—22,026	—958
Missouri, Okla. & Gulf Ry. Co. of Tex.	19	9,946	442	10,539	1,562	1,510	311	7,094	691	11,168	—629	....	197	—826	4,098
Missouri Pacific	3,920	1,587,525	342,155	2,117,604	214,019	385,953	54,397	950,323	67,842	1,672,534	445,070	—4,540	100,123	340,407	161,990
Mobile & Ohio	1,122	900,093	111,293	1,072,342	123,937	230,488	42,485	414,854	33,865	845,629	226,713	—2,097	36,421	188,195	—72,440
Monongahela	67	116,704	2,860	121,053	7,352	5,614	352	24,932	2,466	40,716	80,337	....	2,100	78,237	—10,217
Monongahela Connecting	6	....	....	84,593	7,142	11,664	300	45,377	3,251	67,734	16,859	....	2,425	14,434	—2,127
Morgan's La. & Tex. R. R. & S. S. Co.	405	232,904	90,618	349,775	66,147	53,937	12,116	145,238	12,798	290,236	59,539	—248	23,612	35,679	9,878
Nashville, Chattanooga & St. Louis	1,231	794,906	219,696	1,092,925	158,733	207,514	40,128	408,700	31,632	846,707	246,218	—107	29,400	216,711	11,960
Nevada Northern	165	133,688	11,370	147,922	17,195	21,249	523	33,013	5,996	77,976	69,946	....	7,200	62,746	—8,781
New Orleans & North Eastern	204	240,400	48,741	313,987	35,991	68,296	10,737	122,877	14,425	252,326	61,661	—569	14,200	46,892	—15,993
New Orleans Great Northern	283	107,324	29,463	149,332	19,177	20,344	2,341	42,828	6,883	91,573	57,759	—76	2,964	54,719	—14,059
New Orleans, Mobile & Chicago	403	149,861	27,034	186,939	29,027	29,610	3,792	61,362	8,916	132,707	54,232	—108	6,198	47,926	311
New Orleans, Texas & Mexico	286	96,957	16,613	119,961	52,936	17,734	3,660	52,300	9,043	135,673	—15,712	....	1,000	—16,712	—33,972
New York Central & Hudson River	3,756	5,442,532	2,414,910	8,841,136	1,084,872	1,875,380	148,748	3,532,360	284,381	6,925,741	1,915,395	—98,142	465,030	1,352,223	—100,052
New York, Chicago & St. Louis	566	901,469	89,385	1,022,170	113,853	191,553	45,591	515,088	21,388	887,473	134,697	—2,804	35,000	96,893	6,963
New York, New Haven & Hartford	2,007	2,738,630	2,000,961	5,260,126	536,708	866,463	28,983	2,358,087	139,673	3,929,914	1,330,212	2,837	280,000	1,053,049	162,275
New York, Ontario & Western	566	561,172	76,989	666,241	84,480	118,900	10,194	316,642	17,072	547,288	118,953	—4,415	19,000	95,538	—34,460
New York, Philadelphia & Norfolk	112	221,037	32,528	271,317	25,807	55,158	4,197	133,563	14,838	233,563	37,754	....	8,700	29,054	—20,396

REVENUES AND EXPENSES OF RAILWAYS

Month of March, 1914—Continued

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Passenger.	Total, inc. misc.	Operating expenses: Maintenance: Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
New York, Susquehanna & Western	141	$201,361	$38,783	$257,903	$14,144	$31,556	$1,791	$114,526	$5,729	$167,746	$90,157	—$3,107	$14,055	$73,995	—$2,146
Norfolk & Western	2,037	3,149,061	332,666	3,598,327	328,637	784,245	58,224	1,142,385	82,501	2,395,992	1,202,335	—657	140,000	1,061,678	—32,761
Norfolk Southern	860	257,789	64,107	346,253	47,392	48,821	5,880	125,402	16,674	244,169	102,084	—3,396	10,797	87,891	—48,016
Northern Central	472	831,112	179,463	1,075,721	157,204	250,690	14,434	550,994	32,936	1,006,258	69,463	304	37,131	32,636	52,982
Northern Pacific	6,314	3,549,485	1,067,446	4,947,821	483,508	651,253	93,526	1,799,184	87,331	3,114,802	1,833,019	—8,680	484,644	1,339,695	—363,982
Northwestern Pacific	401	97,734	148,639	268,706	39,306	45,268	4,118	106,274	12,248	207,214	61,492	....	15,498	45,994	17,721
Oahu Ry. & Land Co.	102	67,504	23,799	98,100	7,912	8,196	714	22,279	4,598	43,699	54,401	....	7,250	47,151	925
Oregon Short Line	2,120	1,162,511	367,340	1,641,950	259,774	249,325	39,407	447,963	59,981	1,056,450	585,500	—3,761	111,799	469,940	—33,210
Oregon-Washington R. R. & Nav. Co.	1,915	907,692	360,386	1,369,527	163,751	165,991	47,581	474,819	60,950	913,092	456,435	—4,634	107,122	344,679	35,093
Pecos & Northern Texas	570	155,803	30,963	198,837	15,401	36,630	2,551	58,997	6,720	120,299	78,538	....	7,082	71,456	40,581
Pennsylvania *Co.*	1,750	3,260,242	742,940	4,392,788	530,299	896,882	79,482	1,851,835	121,560	3,480,058	912,730	—10,428	266,274	636,028	334,490
Pennsylvania *Railroad*	4,044	11,160,682	2,727,618	14,851,146	2,206,402	3,076,751	175,299	5,727,218	424,592	11,610,262	3,240,884	—188,741	591,111	2,461,032	21,337
Pere Marquette	2,322	996,130	256,845	1,362,755	158,317	358,486	33,319	619,562	41,718	1,211,402	151,353	3,907	56,664	98,596	—224,294
Philadelphia & Reading	1,020	3,248,948	491,163	3,903,802	379,750	812,275	39,440	1,484,967	65,268	2,781,700	1,122,102	10,579	102,584	1,030,097	—257,908
Philadelphia, Baltimore & Washington	717	789,081	615,526	1,567,962	247,298	306,130	26,913	752,594	54,185	1,387,120	180,842	....	52,996	127,846	—121,995
Pittsburgh & Lake Erie	224	1,423,043	128,831	1,601,596	141,109	356,227	13,653	406,289	31,195	948,473	653,123	—136	53,500	599,487	—83,296
Pittsburgh, Cincinnati, Chic. & St. Louis	1,472	2,440,582	637,494	3,409,552	433,821	739,411	64,060	1,382,130	81,493	2,700,915	708,637	—736	145,607	562,294	384,722
Pittsburgh, Shawmut & Northern	282	188,827	9,617	201,218	18,724	58,595	1,593	74,911	4,577	158,400	42,818	....	1,827	40,991	—433
Port Reading	21	138,405	....	150,927	10,396	190	38	58,668	101	69,393	81,534	9,335	19,000	71,869	15,499
Richmond, Fredericksburg & Potomac	88	122,754	103,737	256,250	24,150	31,678	3,137	96,798	7,560	163,323	92,927	—626	8,000	84,301	—34,802
Rutland	468	152,931	75,652	262,612	33,277	60,616	7,564	128,964	6,797	237,218	25,394	—101	17,791	7,502	—13,325
St. Joseph & Grand Island	319	103,591	24,654	138,779	20,994	18,913	5,170	59,649	6,114	110,840	27,939	—74	7,048	20,817	39,281
St. Louis & San Francisco	4,742	2,490,776	794,120	3,506,175	470,832	856,696	70,847	1,263,357	102,670	2,564,402	941,773	....	116,129	825,644	—289,445
St. Louis, Brownsville & Mexico	518	167,314	69,083	258,536	44,404	24,716	4,876	103,750	10,874	188,620	69,916	....	7,000	62,916	6,520
St. Louis, Iron Mountain & Southern	3,365	2,078,385	492,683	2,773,887	323,690	390,989	53,632	876,251	77,764	1,722,326	1,051,561	—1,396	125,560	924,605	—38,494
St. Louis Merchants' Bridge Terminal	9	....	268	175,040	23,156	12,253	703	96,043	7,082	139,237	35,803	....	6,250	29,553	21,839
St. Louis, San Francisco & Texas	244	65,769	24,811	96,530	27,928	21,636	2,628	59,484	5,763	117,439	—20,909	....	1,476	—22,385	—26,443
St. Louis Southwestern	943	587,145	101,203	717,557	67,577	122,844	29,012	189,012	32,297	440,742	276,815	—1,313	31,512	243,990	—57,547
St. Louis Southwestern of Texas	811	229,542	74,930	333,521	94,515	96,066	13,759	186,582	19,533	410,455	—76,934	208	15,500	—92,642	54,967
San Antonio & Aransas Pass	724	210,320	90,138	320,879	107,744	58,507	6,520	202,025	12,542	387,338	—66,459	....	18,000	—84,459	—113,941
San Pedro, Los Angeles & Salt Lake	1,133	590,428	220,479	861,758	118,280	131,911	32,547	325,908	17,692	626,338	235,420	—4,166	51,082	180,172	—10,681
Seaboard	3,082	1,728,538	508,742	2,461,565	279,884	324,820	62,694	876,344	69,740	1,613,482	848,083	—410	82,000	765,673	—11,636
Southern Railway	7,037	4,135,435	1,364,280	5,952,822	758,870	1,037,698	192,555	2,229,364	190,878	4,409,365	1,543,457	219	224,879	1,318,797	—296,196
Southern in Mississippi	281	60,939	29,867	98,142	22,308	12,877	2,941	46,017	4,076	88,219	9,923	....	7,750	2,173	21,487
Southern Kansas of Texas	179	96,994	13,941	114,804	8,729	25,014	1,466	37,363	3,627	76,199	38,609	....	3,699	34,906	6,697
Southern Pacific Co.	6,435	4,701,534	2,409,336	7,614,037	1,033,402	1,111,688	153,026	2,215,617	232,691	4,746,424	2,867,613	53,250	414,045	2,506,818	—261,360
Spokane International	163	55,743	15,877	74,134	9,787	5,726	1,810	23,906	4,671	45,900	28,234	....	3,081	25,153	—16,307
Spokane, Portland & Seattle	556	221,431	114,065	360,713	58,530	36,032	7,006	93,325	12,944	207,837	152,876	—1,738	53,400	97,738	—10,142
Tennessee Central	294	107,229	30,750	145,461	24,436	17,426	5,518	51,544	7,270	106,194	39,267	....	4,245	35,022	—3,779
Terminal R. R. Assn. of St. Louis	34	....	221	256,008	26,838	20,652	935	101,384	5,082	154,891	101,117	14,915	28,249	87,783	39,782
Texas & New Orleans	458	234,220	96,524	350,204	69,710	81,074	8,911	172,796	13,542	346,033	4,171	—195	18,206	—14,230	—36,638
Texas & Pacific	1,885	1,057,737	339,912	1,490,053	163,594	262,467	35,947	715,208	42,262	1,219,478	270,575	—6,525	62,000	202,050	30,458
Toledo & Ohio Central	446	455,727	43,968	513,745	63,884	102,061	8,121	202,213	11,441	387,720	126,025	—506	20,348	105,171	95,036
Toledo, Peoria & Western	248	62,764	36,570	104,652	18,501	24,465	2,974	51,823	3,664	101,427	3,225	....	6,800	—3,575	—8,101
Toledo, St. Louis & Western	451	323,711	25,390	375,478	34,093	52,541	17,488	182,086	9,315	295,523	79,955	....	17,500	62,455	—22,561
Trinity & Brazos Valley	463	98,923	32,461	138,868	55,425	27,236	8,771	96,689	11,613	199,734	—60,866	....	4,900	—65,766	—50,468
Ulster & Delaware	129	39,110	12,299	54,874	9,072	12,847	1,111	31,880	4,677	59,587	—4,713	—54	3,500	—8,267	—11,365
Union Pacific	3,616	2,619,504	763,258	3,760,095	387,248	596,148	96,918	1,114,789	126,997	2,322,100	1,437,995	—14,076	189,274	1,234,645	92,675
Union R. R. of Baltimore	9	105,226	19,656	127,029	14,316	....	....	5,328	2,727	22,371	104,658	....	6,681	97,977	—29,792
Union R. R. of Pennsylvania	31	....	....	223,173	25,822	98,161	100	153,607	4,360	282,050	—58,877	6,465	7,000	—59,412	—85,109
Vandalia	910	730,441	185,971	1,001,443	156,272	208,517	22,991	413,261	22,106	823,147	178,296	....	32,409	145,887	106,819
Vicksburg, Shreveport & Pacific	171	98,297	40,500	153,028	25,506	29,964	3,552	59,208	5,481	123,711	29,317	—265	7,200	21,852	—10,318
Virginia & Southwestern	240	140,803	12,595	157,096	21,641	39,528	2,094	46,814	4,137	114,214	42,882	....	6,823	36,059	—1,673
Virginian	503	451,790	25,336	489,406	63,724	92,625	5,171	122,439	11,072	295,031	194,375	6,115	22,650	177,840	—46,817
Wabash	2,515	1,784,718	480,654	2,477,586	294,094	464,144	74,835	1,149,030	65,404	2,047,507	430,079	—6,359	99,192	324,528	—5,680
Washington Southern	36	36,510	51,919	115,233	13,188	13,200	1,325	46,814	3,197	77,744	37,489	—692	3,500	33,297	—9,445
West Jersey & Seashore	359	141,031	211,332	376,034	82,447	80,045	11,439	214,131	14,723	402,785	—26,751	—3,373	26,954	—57,078	—79,823
Western Maryland	661	565,075	59,184	660,624	65,711	173,735	24,928	338,258	32,596	635,228	25,396	....	26,000	—604	—126,777
Western Pacific	943	334,496	88,649	436,722	89,168	82,965	25,398	177,018	24,849	399,398	37,324	—2,436	34,986	—98	—80,961
Western Ry. of Alabama	133	82,385	41,313	133,085	23,197	24,397	6,039	38,740	5,453	97,826	35,259	158	5,008	30,409	—4,011
Wheeling & Lake Erie	459	632,558	44,125	717,553	67,170	98,031	14,129	258,065	20,825	458,220	259,333	16	31,568	227,781	229,353
Yazoo & Mississippi Valley	1,372	760,049	205,894	1,046,106	145,231	147,836	15,499	407,562	26,784	742,912	303,194	540	53,500	250,234	10,638

REVENUES AND EXPENSES OF RAILWAYS

NINE MONTHS OF FISCAL YEAR ENDING JUNE 30, 1914

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Operating revenues: Passenger.	Operating revenues: Total, inc. misc.	Operating expenses: Maintenance: Way and structures.	Operating expenses: Maintenance: Of equipment.	Operating expenses: Traffic.	Operating expenses: Transportation.	Operating expenses: General.	Operating expenses: Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Alabama & Vicksburg	143	$926,996	$384,156	$1,414,427	$219,282	$311,600	$35,256	$506,582	$53,580	$1,126,300	$288,127	—$3,756	$76,093	$208,278	—$101,315
Alabama Great Southern	309	2,801,469	993,902	4,123,393	497,012	1,017,404	121,210	1,390,143	95,515	3,121,284	1,002,109	—4,325	142,681	855,103	—156,035
Ann Arbor	292	1,074,489	415,643	1,604,146	178,285	225,535	45,654	600,747	62,335	1,112,556	491,590	—120	122,740	368,730	13,476
Arizona Eastern	367	1,636,108	339,532	2,077,744	282,739	266,350	18,183	571,240	96,431	1,234,943	842,801	236	123,878	719,159	—211,301
Arizona & New Mexico	109	623,941	82,374	737,436	100,958	88,186	7,166	142,226	27,995	366,531	370,905	......	24,383	346,522	—76,310
Atchison, Topeka & Santa Fe	8,348	45,822,012	18,613,640	70,090,646	9,550,324	12,317,085	1,617,951	20,353,909	1,655,187	45,494,456	24,596,190	......	3,531,129	21,065,061	—1,632,416
Atlanta & West Point	93	501,106	375,121	980,196	136,908	201,238	46,386	305,035	41,804	731,371	248,825	1,988	61,536	189,277	—23,855
Atlanta, Birmingham & Atlantic	645	1,942,898	530,784	2,697,876	434,509	435,251	128,153	1,054,340	101,411	2,153,664	544,212	......	129,031	415,181	60,891
Atlantic & St. Lawrence	167	894,553	266,689	1,263,304	194,559	196,462	39,551	604,198	38,740	1,073,510	189,794	......	91,413	98,381	51,014
Atlantic City	167	560,485	1,092,252	1,749,486	342,318	120,309	24,874	897,936	12,607	1,398,044	351,442	—28,787	99,000	223,655	—123
Atlantic Coast Line	4,635	18,543,893	7,061,958	27,658,331	3,792,129	4,421,910	490,861	9,702,475	918,547	19,325,922	8,332,409	—5,842	1,188,000	7,138,567	—772,602
Baltimore & Ohio—System	4,456	57,992,567	12,005,029	74,260,822	9,175,146	12,471,690	1,657,276	29,705,604	1,738,653	54,748,369	19,512,453	—684,344	2,484,947	16,343,162	—2,093,817
Baltimore & Ohio Chicago Terminal	77	....	6,027	1,241,098	152,780	211,592	6,703	582,392	45,214	998,681	242,417	6,947	163,901	85,463	—31,142
Bangor & Aroostook	631	2,128,786	515,490	2,775,263	369,416	381,404	23,375	963,304	90,543	1,828,042	947,221	—1,275	87,589	858,357	296,911
Belt Ry. Co. of Chicago	21	....	....	2,286,277	212,396	237,412	5,383	925,754	57,132	1,438,077	848,200	......	86,747	761,453	—21,252
Bessemer & Lake Erie	204	5,815,054	319,432	6,236,442	632,484	1,804,171	93,844	1,694,256	127,591	4,352,346	1,884,096	......	282,000	1,602,096	—927,946
Bingham & Garfield	27	1,267,687	39,616	1,314,284	85,616	171,808	7,999	197,286	21,315	484,024	830,260	......	26,713	803,547	362,733
Birmingham Southern	44	536,106	9,406	901,836	151,283	131,416	4,540	313,392	40,742	641,373	260,463	......	19,797	240,666	—87,274
Boston & Maine	2,252	20,779,116	12,067,975	35,596,433	5,031,112	5,648,982	342,900	16,912,012	1,002,741	28,937,747	6,658,686	145,262	1,562,486	5,241,462	—1,012,935
* Buffalo & Susquehanna Railroad Corp.	253	415,093	18,994	445,287	66,241	109,590	3,880	165,130	20,462	365,303	79,984	......	7,800	72,184	......
Buffalo & Susquehanna Railway	91	322,402	79,301	425,854	91,276	192,158	4,834	184,180	25,478	497,926	—72,072	—20	14,400	—86,492	30,949
Buffalo, Rochester & Pittsburgh	580	7,393,069	905,595	8,567,828	1,036,534	1,708,595	114,696	3,092,781	181,374	6,133,980	2,433,848	—1,675	162,000	2,270,173	—2,876
Butte, Anaconda & Pacific	90	922,036	113,755	1,131,025	133,129	184,502	5,775	402,596	33,313	759,315	371,710	......	23,256	348,454	220,311
Canadian Pacific Lines in Maine	233	742,693	257,603	1,088,856	313,232	174,097	60,382	508,964	46,604	1,103,279	—14,423	......	99,000	—113,423	—145,186
Carolina, Clinchfield & Ohio	248	1,760,941	155,524	1,954,917	131,174	242,849	60,791	359,190	81,398	875,402	1,079,515	......	98,250	981,265	—6,549
Carolina, Clinchfield & Ohio of S. C.	18	106,911	16,960	126,368	7,725	787	13,697	22,580	5,300	50,089	76,279	......	6,750	69,529	741
Central of Georgia	1,924	7,377,713	2,937,243	11,257,451	1,514,997	2,190,030	315,961	3,775,468	361,544	8,158,000	3,099,451	55,679	474,517	2,680,613	21,970
Central of New Jersey	676	15,491,692	4,213,872	20,465,290	2,376,428	3,465,199	290,430	6,613,791	413,412	13,159,260	7,306,030	—3,138	1,000,633	6,302,259	—2,026,037
Central New England	297	2,301,056	346,379	2,786,449	394,881	337,353	11,921	987,444	41,278	1,772,877	1,013,572	—4,079	97,500	911,993	—324,461
Central Vermont	411	2,004,783	791,851	3,015,489	482,898	584,037	80,364	1,578,478	76,171	2,801,948	213,541	2,737	140,980	75,298	—289,692
Charleston & Western Carolina	341	1,247,981	304,384	1,624,511	290,590	260,268	30,640	612,433	42,650	1,236,581	387,930	......	45,000	342,930	36,823
Chesapeake & Ohio Lines	2,343	21,575,921	4,583,118	27,405,422	2,927,322	5,840,546	499,990	9,086,794	680,789	19,035,441	8,369,981	7,121	1,025,123	7,351,979	—13,162
Chicago & Alton	1,026	6,970,292	3,177,036	11,016,780	1,373,727	2,812,336	400,095	4,389,168	341,196	9,316,522	1,700,258	—28,101	407,900	1,264,257	—428,774
Chicago & Eastern Illinois	1,283	9,183,831	2,274,892	12,428,186	1,868,201	3,233,430	214,607	4,639,794	351,515	10,307,547	2,120,639	—22,869	459,800	1,637,970	—995,299
Chicago & Erie	270	3,251,619	523,370	4,161,802	816,465	1,058,870	195,013	2,219,225	119,443	4,409,016	—247,214	—31,062	138,012	—416,288	—385,059
Chicago & North Western	8,063	41,520,133	16,388,707	63,730,338	8,323,633	9,174,284	1,039,752	24,360,199	1,313,926	44,211,794	19,518,544	4,569	3,077,000	16,446,113	—393,486
Chicago, Burlington & Quincy	9,129	48,994,271	16,753,305	72,124,149	7,593,448	12,014,174	1,217,065	23,356,845	1,757,508	45,939,040	26,185,109	—138,357	2,745,034	23,301,718	—1,114,821
Chicago Great Western	1,496	7,597,957	2,475,094	10,903,225	1,522,960	1,737,952	429,953	4,138,557	327,170	8,156,592	2,746,633	—5,758	355,645	2,385,230	—280,767
Chicago, Indiana & Southern	359	3,010,059	241,380	3,355,817	481,618	1,061,893	81,332	1,197,570	92,853	2,915,266	440,551	2,283	150,266	292,568	—370,480
Chicago, Indianapolis & Louisville	617	3,521,340	1,275,583	5,257,650	772,889	820,068	173,288	1,990,941	146,527	3,903,713	1,353,937	......	235,102	1,118,835	—76,512
Chicago Junction	12	....	....	1,551,855	156,367	150,420	10,406	829,026	41,267	1,187,486	364,369	78,036	24,055	418,350	—17,691
Chicago, Milwaukee & St. Paul	9,690	49,984,532	14,302,850	70,034,298	7,855,878	10,149,104	1,374,885	25,723,221	1,293,374	46,396,462	23,637,836	160,301	3,060,039	20,738,098	—1,475,071
Chicago, Peoria & St. Louis	255	957,637	248,701	1,281,051	251,172	308,326	60,024	629,970	46,832	1,296,324	—15,273	......	46,400	—61,673	—111,751
Chicago, Rock Island & Gulf	477	1,530,439	502,399	2,198,778	260,983	286,493	86,629	893,556	71,063	1,598,724	600,054	—7,792	88,611	503,651	—429,182
Chicago, Rock Island & Pacific	7,681	32,738,659	14,029,027	49,974,835	6,226,643	7,024,989	1,374,395	20,807,135	1,424,879	36,858,041	13,116,794	—131,719	2,496,944	10,488,131	—501,168
Chicago, St. Paul, Minneapolis & Omaha	1,747	8,912,542	4,115,058	13,892,563	1,787,549	1,716,254	264,870	5,344,821	328,232	9,441,726	4,450,837	12,668	722,617	3,740,888	344,082
Chicago, Terre Haute & Southeastern	362	1,549,004	154,107	1,742,199	240,564	485,734	33,247	554,845	80,276	1,394,666	347,533	—2,252	103,500	241,781	—49,082
Cincinnati, Hamilton & Dayton	1,015	5,498,005	1,247,008	7,540,546	1,316,405	1,371,933	192,206	3,730,595	185,303	6,796,442	744,104	......	314,855	429,249	—1,034,847
Cincinnati, New Orleans & Texas Pacific	337	6,205,634	1,587,759	8,184,146	796,120	2,071,207	227,643	2,421,756	188,917	5,705,643	2,478,503	—8,382	275,000	2,195,121	—268,092
Cincinnati Northern	245	909,069	178,058	1,135,965	269,438	314,323	28,416	508,329	32,576	1,149,482	—13,517	......	52,059	—65,576	—218,211
Cleveland, Cincinnati, Chic. & St. Louis	2,364	18,512,126	6,842,788	27,769,350	4,087,573	6,986,069	705,191	12,242,024	622,832	24,643,689	3,125,661	—14,813	1,098,168	2,012,680	—4,616,499
Colorado Midland	338	1,039,362	211,792	1,368,942	247,913	332,189	71,040	615,456	51,584	1,318,182	50,760	—3,957	78,000	—31,197	—178,854
Colorado & Southern	1,127	4,381,212	1,157,420	5,924,224	797,740	1,130,058	96,844	2,140,808	196,372	4,361,822	1,562,402	—6,729	298,446	1,257,227	—539,935
Cumberland Valley	162	1,953,353	535,847	2,606,299	535,840	311,134	46,993	917,319	77,895	1,889,111	717,188	1,348	55,065	663,471	—134,905
Delaware & Hudson Co.—R. R. Dept.	880	14,136,583	2,424,974	17,199,108	1,361,698	2,761,774	243,663	6,611,693	603,945	11,582,723	5,616,335	—9,961	489,454	5,116,920	—1,639,811
Delaware, Lackawanna & Western	960	21,210,399	6,411,729	29,611,504	3,545,999	4,661,749	648,879	9,477,660	627,641	18,961,928	10,649,576	333,858	1,545,000	9,438,434	—1,426,250
Denver & Rio Grande	2,583	13,214,946	3,976,533	17,974,190	2,552,266	3,309,866	378,852	5,671,553	478,202	12,390,739	5,583,451	—5,731	808,600	4,769,120	—582,306
Denver & Salt Lake	233	566,480	268,557	883,369	160,138	143,006	18,003	296,828	40,010	657,985	225,384	......	36,500	188,884	—5,674
Detroit & Mackinac	411	586,157	260,012	906,749	102,240	145,895	21,121	336,919	24,393	630,568	276,181	496	78,469	198,208	—7,045
Detroit & Toledo Shore Line	79	1,234,215	....	1,246,301	114,843	98,556	15,689	351,153	24,084	604,325	641,976	......	50,706	591,270	106,322
Detroit, Grand Haven & Milwaukee	191	1,141,967	500,353	1,917,841	215,956	279,282	61,832	1,042,859	47,711	1,647,640	270,201	646	32,400	238,447	174,918
† Detroit River Tunnel	...	....	....	....	....	....	....	....	....	....	....	......	....	....	....

* Figures shown here are for 3 months ending March 31, 1914. Company reorganized on January 1, 1914. † Included in Michigan Central beginning January 1, 1914.

Traffic News

The Western Classification Committee will hold a public hearing in Chicago on May 18, to consider applications for changes in ratings, rules, etc., in Classification No. 52, on chairs, wind-mill parts and harness and saddlery.

At Calgary, Alberta, on April 17, the sales of live stock at the stock yards aggregated $142,000. Over 4,000 hogs were shipped that day to Seattle, Wash. On the third of April 2,300 hogs were shipped to Seattle. Recently 4,400 hogs were shipped from Alberta to Toronto.

The Western Express Company has announced that it will open offices in Chicago and Milwaukee by July 1. The company operates over the Minneapolis, St. Paul & Sault Ste. Marie, the Duluth, South Shore & Atlantic, the Canadian Pacific and the Spokane International.

It is reported that the American and the Wells-Fargo Express companies are active bidders for the contracts for doing the express business on the Rock Island, the St. Louis & San Francisco, the Baltimore & Ohio and the Lehigh Valley roads. Contracts on these roads are to be given up by the United States Express Company, which is going out of business at the end of June.

The passenger department of the New York, Chicago & St. Louis is issuing a monthly publication for distribution among its representatives entitled *Service News*. It is designed to be a medium for giving information in regard to new trains, equipment and other matters connected with the passenger service, and it is also a model text book of diplomatic advice as to how to please the traveling public.

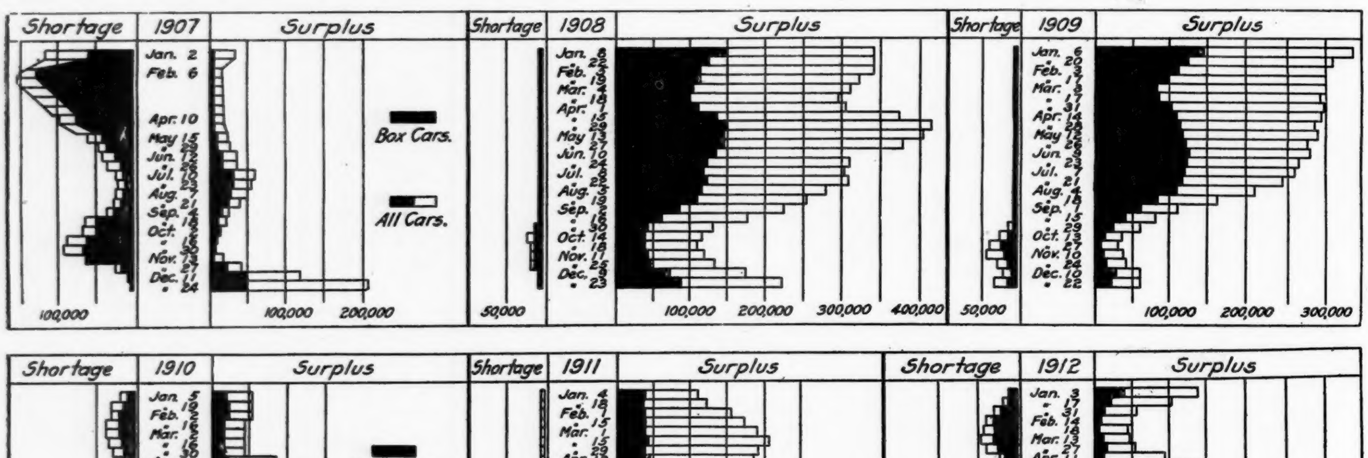
Beginning May 31 the Canadian Pacific will have through passenger trains from Montreal to Chicago, over both the Wabash and the Michigan Central. Over the Michigan Central a new daily train will be run each way. The train from Chicago to Montreal will be known as the "Canadian," and the train from Montreal to Chicago will be known as the "American." The trains will leave in the morning and will arrive in the other city the following morning.

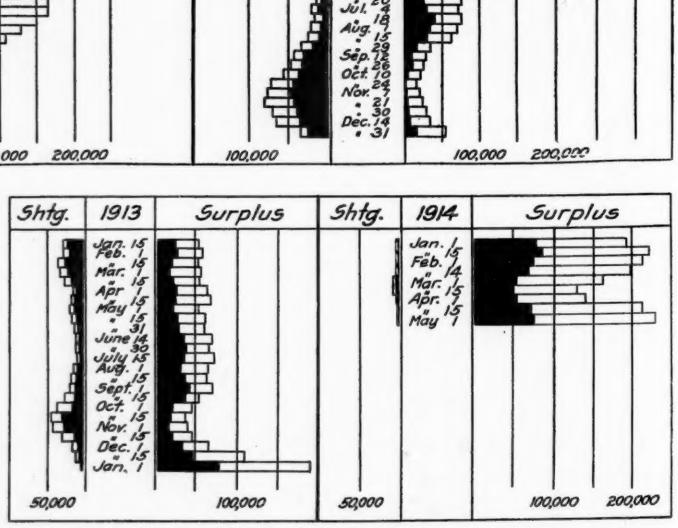
The Southern Railway has announced that in order to give increased facilities for travel from St. Louis, Louisville, Cincinnati, and other western points to Asheville, and other western Carolina resorts, with the opening of the summer tourist season through trains with Pullman sleeping cars and with coaches and dining cars are to be put on between St. Louis and Asheville; also giving improved local service between Knoxville, Tenn., and Asheville, as trains Nos. 11 and 12 will be relieved of through connection. The present service of trains Nos. 23 and 24, the St. Louis Special between St. Louis and Danville, Ky., and trains Nos. 111 and 112, between Harriman Junction, Tenn., and Knoxville will be utilized and new service will be established by the Queen & Crescent Route between Danville and Harriman Junction, and by the Southern Railway between Knoxville and Asheville.

A movement for the comprehensive development of the whole inland waterway system was organized in the offices of the Business Men's League of St. Louis last week under the direction of the governors of Minnesota, Illinois and Missouri, by delegates representing the commercial clubs of cities and towns on the Mississippi river from Minneapolis and St. Paul to New Orleans. Arrangements were made to enlarge the initial organization by bringing into the movement the governors of all Mississippi river states, and the commercial associations of all the Mississippi river cities and towns, and to endeavor to enlist the co-operation of the United States government. Governors Eberhart, Dunne and Major were appointed as a committee to prepare a definite plan for an organization, and to formulate a plan for a comprehensive inland waterway and terminal improvement by all the shipping points on the Mississippi river and its tributaries.

Car Surpluses and Shortages

Arthur Hale, chairman of the committee on relations between railroads of the American Railway Association, in presenting statistical bulletin No. 167, giving a summary of car surpluses and shortages by groups from December 31, 1912, to May 1,





Car Surpluses and Shortages, 1907 to 1914

1914, says: The total surplus on May 1, 1914, was 230,533 cars; on April 15, 1914, 213,324 cars; on May 1, 1913, 53,977 cars; on April 25, 1912, 151,186 cars; on April 26, 1911, 189,524 cars, and on April 27, 1910, 102,085 cars.

A slight reduction of surplus is to be noted in the southeast and southwest (groups 4, 5 and 9), and a heavy increase in surplus in the eastern district (groups 1, 2 and 3). Surplus cars continue to increase, and we now have the largest surplus for any period since 1909.

The total shortage on May 1, 1914, was 1,654 cars; on April 15, 1914, 455 cars; on May 1, 1913, 14,178 cars; on April 25, 1912, 12,305 cars; on April 26, 1911, 2,518 cars, and on April 27, 1910, 5,766 cars.

A small shortage of box cars has developed in the middle west (group 6).

The accompanying table gives car surplus and shortage figures by groups for the last period covered in the report and the diagram shows total bi-weekly surpluses and shortages from 1907 to 1914.

Car Surpluses and Shortages

Date	No. of roads.	Surpluses: Box.	Surpluses: Flat.	Surpluses: Coal, gondola and hopper.	Surpluses: Other kinds.	Surpluses: Total.	Shortages: Box.	Shortages: Flat.	Shortages: Coal, gondola and hopper.	Shortages: Other kinds.	Shortages: Total.
Group *1.—May 1, 1914	7	606	349	1,620	506	3,081	53	10	0	1	64
" 2.— " 1, 1914	30	2,865	423	16,536	3,831	23,655	3	0	0	0	3
" 3.— " 1, 1914	28	6,856	1,703	42,205	6,023	56,787	0	0	0	106	106
" 4.— " 1, 1914	11	6,570	1,093	4,820	1,982	14,465	0	0	0	55	55
" 5.— " 1, 1914	19	4,356	706	14,039	2,406	21,507	50	0	0	0	50
" 6.— " 1, 1914	26	12,895	888	11,675	8,459	33,917	1,247	38	19	0	1,304
" 7.— " 1, 1914	4	1,782	61	1,373	1,943	5,159	0	0	0	0	0
" 8.— " 1, 1914	18	6,551	479	3,653	3,486	14,169	10	0	10	1	21
" 9.— " 1, 1914	11	3,392	241	572	1,592	5,797	0	0	0	0	0
" 10.— " 1, 1914	22	12,819	1,845	3,906	11,837	30,407	40	0	0	0	40
" 11.— " 1, 1914	4	17,308	1,257	0	3,024	21,589	0	0	0	11	11
Total	180	76,000	9,045	100,399	45,089	230,533	1,403	48	29	174	1,654

***Group 1 is composed of New England lines; Group 2—New York, New Jersey, Delaware, Maryland and Eastern Pennsylvania lines; Group 3—Ohio, Indiana, Michigan and Western Pennsylvania lines; Group 4—West Virginia, Virginia, North and South Carolina lines; Group 5—Kentucky, Tennessee, Mississippi, Alabama, Georgia and Florida lines; Group 6—Iowa, Illinois, Wisconsin and Minnesota lines; Group 7—Montana, Wyoming, Nebraska, North Dakota and South Dakota lines; Group 8—Kansas, Colorado, Missouri, Arkansas and Oklahoma lines; Group 9—Texas, Louisiana and New Mexico lines; Group 10—Washington, Oregon, Idaho, California, Nevada and Arizona lines; Group 11—Canadian lines.**

Car Location

The accompanying table, which was taken from bulletin No. 17A of the American Railway Association, gives a summary of freight car location by groups on April 15, 1914.

Car Location on April 15, 1914

	New England.	N.Y., N.J., Del., Md., Eastern Pa.	Ohio, Ind., Mich., Western Pa.	Va., W. Va., No. & So. Carolina.	Ky., Tenn., Miss., Ala., Ga., Fla.	Iowa, Ill., Wis., Minn.	Mont., Wyo., Neb., Dakotas.	Kans., Colo., Okla., Mo., Ark.	Texas, La., New Mexico.	Oregon, Idaho, Nev., Cal., Ariz.	Canadian Lines.	Grand Total.
Total Cars Owned	88,452	690,799	267,677	208,496	177,336	491,565	19,959	115,111	31,548	139,164	152,793	2,382,900
Home Cars on Home Roads	52,172	442,038	117,614	133,486	111,272	349,564	9,856	77,260	19,027	83,778	103,285	1,499,352
Home Cars on Foreign Roads	36,280	248,761	150,063	75,010	66,064	142,001	10,103	37,851	12,521	55,386	49,508	883,548
Foreign Cars on Home Roads	45,825	235,734	172,877	77,034	58,668	123,182	10,518	33,873	18,426	46,594	31,161	853,892
Total Cars on Line	97,997	677,772	290,491	210,520	169,940	472,746	20,374	111,133	37,453	130,372	134,446	2,353,244
Excess or Deficiency	9,545	*13,027	22,814	2,024	*7,396	*18,819	415	*3,978	5,905	*8,792	*18,347	*29,656
Surplus	2,136	36,193	30,148	18,239	22,715	32,757	4,079	10,888	6,313	27,654	22,202	213,324
Shortage	42	3	100	55	50	61	...	11	5	...	128	455
Shop Cars—												
Home Cars in Home Shops	6,617	53,824	18,896	16,898	13,250	31,984	808	9,879	3,169	6,893	7,107	169,325
Foreign Cars in Home Shops	1,115	6,513	6,613	1,723	1,447	4,144	555	1,084	703	2,572	222	26,691
Total Cars in Shop	7,732	60,337	25,509	18,621	14,697	36,128	1,363	10,963	3,872	9,465	7,329	196,016
Per Cent. to Total Cars Owned—												
Home Cars on Home Roads	58.98	63.99	43.94	64.02	62.75	71.11	49.38	67.12	60.31	60.20	67.60	62.92
Total Cars on Line	108.38	98.11	108.44	100.97	95.83	96.15	102.08	94.85	118.72	93.68	87.99	98.76
Home Cars in Home Shops	7.48	7.79	7.06	8.10	7.47	6.54	4.05	8.58	10.04	4.95	4.65	7.11
Foreign Cars in Home Shops	.97	.94	2.47	.83	.82	.85	2.78	.84	2.23	1.85	.15	1.12
Total Cars in Shops	8.45	8.73	9.53	8.93	8.29	7.39	6.83	9.42	12.27	6.80	4.80	8.23

*Denotes deficiency.

Additional Chicago Water Transportation Facilities

The Chicago, St. Louis & Gulf Transportation Company has issued its initial tariff of class rates on freight between Chicago and Illinois points. The reduction under the railway tariffs is said to be about 20 per cent. The Chicago terminal for the boat line will be that of the Merchants' Lighterage Company until docks can be built. Calls will be made at all private docks on the Chicago river, the Illinois and Michigan canal, and the Illinois and Mississippi rivers.

Commission and Court News

INTERSTATE COMMERCE COMMISSION

Fresh Meat and Packing House Products from Austin, Minn.

George A. Hormel & Company v. Chicago, Milwaukee & St. Paul et al. Opinion by Commissioner McChord:

In the previous report in this case it was held that a rate of 20 cents on fresh meat and packing house products from Austin, Minn., to Chicago was unreasonable and discriminatory against Austin as compared to Mason City, Waterloo, Marshalltown, Ottumwa and Cedar Rapids, Ia., in that it exceeded 18.5 cents per 100 lb. on fresh meat and 16.5 cents on packing house products. In view of evidence taken at the rehearing it is now held that these rates should not exceed 18 and 16 cents per 100 lb. respectively. The commission also finds that the exaction from South St. Paul to Chicago of higher rates on fresh meat and packing-house products than are contemporaneously maintained from Austin constitutes unjust discrimination and that the parity heretofore existing between these points should be re-established by the granting to South St. Paul of the rates prescribed from Austin. (30 I. C. C., 98.)

Lumber Rates from North Pacific Coast Points

Opinion by Commissioner McChord:

The commission finds that the Union Pacific is justified in its proposed intention to limit to its own route via Council Bluffs the application of the rates on lumber and other forest products from points on the Oregon-Washington Railroad & Navigation

Company to points on or east of the Missouri river and to cancel thereby the other route via Plummer, Idaho, and the lines of the Chicago, Milwaukee & St. Paul. As the Oregon-Washington, the Oregon Short Line and the Union Pacific are regarded as one system, they are within their rights when they act with the end in view of securing their lines the largest practicable haul on this traffic originating on their own system. Rates via the route through Council Bluffs, however, must not exceed those from the same points via Plummer. (30 I. C. C., 111.)

STATE COMMISSIONS

The Wisconsin Railroad Commission has issued an order reducing the switching charges on the Chicago, Milwaukee & St. Paul in the Milwaukee terminal district.

The Louisiana Railroad Commission has issued an order authorizing the railroads operating in Louisiana east of the Mississippi river to use Southern Classification No. 40, provided that all exceptions made by the commission to previous issues shall apply to Classification No. 40.

The Atchison, Topeka & Santa Fe has filed with the Missouri Public Service Commission a motion for a re-hearing of the case in which the commission ruled that railroads and railroad officers are prohibited from using telegraph blanks or contracts for half rates with the telegraph companies.

The Southern Pacific has filed an application with the California Railroad Commission in which it asks for authority to increase its fares between San Francisco and suburban points in Alameda county. This includes the commutation and one ride rates on the Melrose branch on the Berkeley system, and on the Oakland Seventh street line.

The New York State Public Service Commission, Second district, has disapproved tariffs filed by the railroads discontinuing joint through rates on freight to and from points on the South Buffalo Railway. The South Buffalo belongs to the Lackawanna Steel Company, and the railroads had discontinued through rates in accordance with the views promulgated by the Interstate Commerce Commission in interstate cases of similar character.

The Railway Commissioners of Canada have suspended tariffs filed by the principal roads terminating in or near Windsor, Ont., discontinuing through tariffs on freight to and from points on the Essex Terminal Railway, which is controlled by the United States Steel Corporation. In this action the Canadian Commission agrees with that of the state of New York, referred to above, in disapproval, at least until after hearing, of the position taken by the Interstate Commerce Commission in the matter of rates of transportation for freight on short industrial railroads.

Following a hearing at Springfield last week the Illinois Public Utilities Commission has issued an order that all railways in the state must comply by July 1 with the provisions of the state electric headlight law, which requires headlights on passenger locomotives which enable the engineer to clearly distinguish a man 800 ft. away on the track. The railway employees' organizations petitioned the commission to enforce the law. The railways asked for a postponement pending the decision of the United States Supreme Court in a case involving the Georgia headlight law. The commission announced that it need not be concerned about the action of the court, holding this unnecessary, because the Illinois order applies only to intrastate traffic.

COURT NEWS

The Supreme Court of the United States has upheld the constitutionality of the Texas statute, allowing attorney fees in cases of failure to pay just claims within 30 days after demand. The Missouri, Kansas & Texas attacked the constitutionality of the law in a case in which L. C. Cade, a section hand, made a claim against it for $10.75 back wages. The case was appealed direct from a Justice of the Peace court in Dallas county, Tex.

Awarding Reparation and Fixing Rates for the Future

The decision of the United States Supreme Court, holding that the Interstate Commerce Commission might award reparation for past overcharges without fixing rates for the future, which was briefly reported in the *Railway Age Gazette* of May 1, was made in the case of Baer Brothers of Leadville, Colo., against the Denver & Rio Grande; the decision is by Mr. Justice Lamar. The Circuit Court had decided in favor of the plaintiff, but the Circuit Court of Appeals reversed the decision. The Supreme Court now finds that the lower court was right and decides against the road.

Beer, in car loads, was shipped from St. Louis to Leadville during a period of about five years. The rate was 45 cents per 100 lb. from St. Louis to Pueblo, 923 miles, and the same price, 45 cents, from Pueblo to Leadville, 160 miles. There was no through rate. It was admitted that 45 cents, St. Louis to Pueblo, was reasonable. The Interstate Commerce Commission ordered the rate from Pueblo to Leadville to be reduced to 30 cents per 100 lb. The commission made no order as to rates for the future, the reason being, apparently, that such action should not be taken without further investigation, which the commission apparently was not disposed to make. The sum ordered refunded was $3,438.

The opinion of the Circuit Court of Appeals, that an order for reparation was void unless it prescribed a rate for the future, appears to have been based on the view that the action of the commission had left open a chance for discrimination.

The Supreme Court says that awarding reparation for the past, and fixing rates for the future, involve the determination of matters essentially different. One is in its nature private and the other public. One is made by the commission in its quasi judicial capacity to measure past injuries sustained by a private shipper; the other in its quasi legislative capacity to prevent future injury to the public. Both subjects can be dealt with together, but not necessarily. Persons entitled to reparation may have no interest in a future rate; others interested in a future rate may have no interest in the past conditions. A rate which was reasonable when made, may become unreasonable as the result of a gradual change in conditions, so that no reparation is ordered, even though a new rate be established. Even if the commission errs in not naming a new rate, that does not make its award of reparation void. The court should not punish the shipper for the failure of the commission. A shipper may, or may not, intend to remain in business. The commission found that the rate of 45 cents from Pueblo was 15 cents too high. If other shippers found that they did not get the benefit of this opinion they could, on application, secure a modification of the order so that they could recover unjust collections. So far as the future operation of the order was concerned, all shippers were in exactly the same position. On the trial the road tried to make out that the shipment was not interstate, but the court summarily sweeps aside this argument.

Texas Conductor Law Invalid

The Supreme Court of the United States this week declared unconstitutional the statute of Texas which provides that except in cases of emergency a person shall not act as a freight conductor without having had two years' experience as a freight brakeman. The decision was by Justice Lamar. While the public has a right to fix standards and tests for persons serving in semi-public positions, it cannot establish arbitrary rules which give certain classes a monopoly. Justice Lamar declared that the law gave freight brakemen a monopoly of the right to succeed to freight conductors, and excluded therefrom all others, including firemen, engineers, passenger conductors and passenger brakemen.

"The law does not require a freight brakeman to be qualified, but it does shut out all others of the public who might show themselves by proper tests to be qualified. It does this in the face of the practice of railroads recognizing that engineers become qualified to act as conductors."

Justice Holmes dissented.

The case was that of W. W. Smith, an engineman on freight trains of the Texas & Gulf, convicted of violating the law by acting as conductor of a freight train on one trip.

Railway Construction in Cuba.—The committee of public works has reported favorably on the project of a railway from Casilda, the port of Trinidad on the south coast to Placetas del Sur, in Santa Clara province on the main line of the Cuba Railroad.

Railway Officers

Executive, Financial, Legal and Accounting

R. J. Lockwood, manager of the New Iberia & Northern, has been elected vice-president, with headquarters at New Iberia, La., in place of J. M. Burguieres.

K. Bowerfind, secretary and treasurer of the Texas Central, has been appointed general paymaster of the Missouri, Kansas & Texas of Texas, with headquarters at Dallas, Tex.

T. U. Young has been appointed assistant to the vice-president and general manager of the Jonesboro, Lake City & Eastern, with headquarters at Jonesboro, Ark., effective May 1.

The office of Agnew T. Dice, vice-president and general manager of the Philadelphia & Reading, and subsidiary companies, has been removed from Reading, Pa., to the Reading terminal, Philadelphia.

Samuel L. Kamps, formerly assistant to the operating vice-president of the Chicago Great Western, was recently appointed assistant to the chief executive officer of the Pere Marquette, with headquarters at Detroit, Mich.

J. J. McManus, assistant freight claim agent of the Northern Pacific at St. Paul, Minn., has been transferred to Tacoma, Wash., in a similar capacity, succeeding J. M. Mooney, who is transferred to St. Paul, in place of Mr. McManus.

The election of Edward T. Stotesbury, a director of the Philadelphia & Reading, as chairman of the board, and of Theodore Voorhees, vice-president, as president of that road, with headquarters at Philadelphia, Pa., succeeding George F. Baer, deceased, is commented on elsewhere in this issue.

C. B. Heiserman, general solicitor of the Pennsylvania Lines West of Pittsburgh, with office at Pittsburgh, Pa., has been appointed general counsel, succeeding J. J. Brooks, deceased, effective May 1, and E. H. Seneff, general solicitor of the Chicago & Eastern Illinois, at Chicago, succeeds Mr. Heiserman, effective June 1.

Operating

E. W. Fowler has been appointed inspector of transportation of the Chicago Great Western, with headquarters at Chicago.

J. C. Nolan, master mechanic of the St. Louis, Brownsville & Mexico, has been appointed superintendent, with headquarters at Kingsville, Tex., succeeding R. F. Carr.

Traffic

F. E. Waters has been appointed traveling freight agent of the Atlanta, Birmingham & Atlantic, with office at Atlanta, Ga., succeeding Jos. H. Banks, resigned.

H. C. Bush, member of the Western Classification Committee, has been appointed a member of the Committee on Uniform Classification, with office at Chicago, succeeding R. C. Fyfe, chairman of the former committee.

E. S. Reader, traveling passenger agent of the Western Pacific, Denver & Rio Grande, and Missouri Pacific-Iron Mountain system, with headquarters at Doyle, Cal., has been appointed general agent at Reno, Nev.

Bryan Snyder, traffic manager of the Marshall & East Texas, has been appointed also traffic manager of the New Iberia & Northern, with office at New Iberia, La., succeeding S. S. Butler, resigned. Mr. Snyder's duties will include those of general freight agent and general passenger agent heretofore handled by J. A. Brown and C. W. Strain at Houston, Tex.

C. J. Brister, whose appointment as traffic manager of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, has already been announced in these columns, was born June 22, 1875, at Dayton, Ohio. He was educated in the public schools of Dayton, and began railway work in 1890 with the Dayton, Ft. Wayne & Chicago at Dayton as stenographer. In February of the following year he became a stenographer in the joint office of the Union Pacific and the Chicago & North Western at Cincinnati, where he remained until January, 1892, when he went to the Cleveland, Cincinnati, Chicago & St. Louis, with which road he has remained ever since. He has been successively stenographer, rate clerk, chief clerk, assistant general freight agent, general freight agent, and now he becomes traffic manager, as above noted.

Edward T. Campbell, whose appointment as general traffic manager of the Erie, with headquarters at Chicago, has already been announced in these columns, was born at Lansingburgh, N. Y. He was educated in the public schools and began railway work in February, 1891, as contracting freight agent for the Queen & Crescent route. From February to June, 1893, he was with the Chesapeake, Ohio & Southwestern as chief clerk, and the following two years he was secretary of the I. W. freight bureau. He was then, in June, 1895, made chairman of the Southwestern freight bureau, which position he held until 1899. In August, 1900, he was appointed purchasing agent of the Minneapolis & St. Louis, resigning in May, 1902, to become purchasing agent of the Erie, with headquarters at New York. Seven years later Mr. Campbell was made traffic manager of the latter road, with office at Chicago, which position he held at the time of his recent promotion to general traffic manager, as above noted. Mr. Campbell's appointment is another example of the increasing recognition by the Erie of the importance of the Chicago terminal. Since January 1, H. O. Dunkle has been appointed general manager of the Chicago terminals division and the lake lines, and assistant to the president, C. Kamerer, has been appointed assistant to the general manager, and James Burke has been appointed superintendent, all at Chicago.

E. T. Campbell

Engineering and Rolling Stock

A. C. Hinckley, who has been appointed superintendent of motive power and machinery of the Oregon Short Line, with headquarters at Salt Lake City, Utah, as has already been mentioned in these columns, was born in New York in 1863. He passed through the grammar school and attended Meads College for two years, beginning railway work about 1885 with the Chicago, Pekin & Southwestern, with which road he remained for six years as apprentice and machinist. He was then for three years locomotive engineer on the Chicago, Burlington & Northern out of LaCrosse, Wis., and subsequently was for three years with the Utah Central as road foreman of engines and master mechanic at Salt Lake City, Utah; master mechanic of the Denver & Rio Grande at Salida, Colo., for three years; and in charge of the mechanical and car departments of the Cincinnati, Hamilton & Dayton at Lima, Ohio, for four and a half years. Mr. Hinckley went to the Southern Pacific in January, 1910, as mas-

A. C. Hinckley

ter mechanic at West Oakland, Cal., which position he resigned to become superintendent of motive power and machinery of the Oregon Short Line, as above noted, on May 1.

E. D. Flad has been appointed assistant supervisor of division No. 32 of the Pennsylvania Railroad, with office at Earnest, Pa., succeeding C. S. Hager, promoted.

H. C. Griffin has been appointed general car inspector of the Canadian Pacific, Eastern lines, with headquarters at Montreal, Que., succeeding L. C. Ord, promoted.

J. T. Luscombe has been appointed master mechanic of the Ohio River division of the Baltimore & Ohio, with office at Parkersburg, W. Va., succeeding J. B. Elliott.

The headquarters of P. T. Simons, assistant engineer of the Missouri Pacific-Iron Mountain system, Southern district, has been transferred from St. Louis, Mo., to Little Rock, Ark.

R. E. Rowe, roundhouse foreman of the St. Louis, Brownsville & Mexico, has been appointed master mechanic, with headquarters at Kingsville, Tex., to succeed J. C. Nolan, promoted.

J. J. Carey, master mechanic of the Baltimore & Ohio Southwestern at Washington, Ind., has been appointed master mechanic of the Texas & Pacific, with office at Marshall, Tex., in place of G. H. Langton, resigned.

L. B. Wickersham, chief electrical engineer of the Oregon Electric, Spokane & Inland Empire and the United Railways, has been appointed assistant general manager, with headquarters at Portland, Ore., and the former position is abolished.

OBITUARY

Henry M. Moran, chief despatcher of the Northern Pacific at Seattle, Wash., died on April 26.

Irwin Mitchell, general dairy agent of the Rock Island Lines, with office at Vinton, Iowa, died on May 12, at that place.

John G. Steacy, formerly general manager and assistant superintendent of the St. Louis & Southwestern, and for many years engaged in the construction of railway lines, died at his home in Brockville, Ont., on May 9, at the age of 77.

J. B. Smalley, assistant general manager of the Second district of the Chicago, Rock Island & Pacific, with headquarters at Topeka, Kan., died in the latter city on May 8. His death was due to a stroke of paralysis, brought on, it is said, by strain caused by hours of work without sleep in the flood district of the Cimarron valley in western Kansas. He suffered the attack on May 6 while superintending the reconstruction of washed out bridges. Mr. Smalley had been in railway service about 40 years.

Benjamin A. Newland, general manager of the Tennessee Railway, was killed on May 9, in an accident while riding in a motor car on that road, near Oneida, Scott county, Tenn. He was born in February, 1852, at Lenoir, N. C., and began railway work in 1876, and was then consecutively to 1888, conductor on the Western North Carolina and the Richmond & Danville. He was then traveling passenger agent on the East Tennessee, Virginia & Georgia and the Chicago & Alton until 1892, when he was appointed traveling passenger agent on the Seaboard Air Line. The following year he was appointed general traveling passenger agent and later was general agent in the passenger department of the same road. In June, 1900, he was appointed superintendent of transportation of the Atlantic & North Carolina, and subsequently became general manager of the Tennessee Railway.

Railway Construction in Colombia.—A concession has recently been granted for the construction of an interurban tramway line connecting Barranquilla and the towns of Galapa, Baranoa, Usuiacari, and Savana Larga, covering a distance of about 40 miles through important agricultural territory. This line could be easily extended, if requirements warranted, to connect with the Cartagena railway, giving these two coast cities rail communication of much value to each. It will tap the country now being explored for petroleum by various interests.

Equipment and Supplies

LOCOMOTIVE BUILDING

The Rutland is in the market for one superheater switching locomotive.

The San Joaquin & Eastern has ordered one ten-wheel type locomotive from the Baldwin Locomotive Works.

The Georgia Coast & Piedmont has ordered 2 ten-wheel type locomotives from the Baldwin Locomotive Works.

The Carnegie Steel Company has ordered one six-wheel switching locomotive from the Baldwin Locomotive Works.

The Maryland & Pennsylvania has ordered 2 consolidation type locomotives from the Baldwin Locomotive Works.

The Seaboard Air Line is contemplating the purchase of 10 passenger and 15 freight locomotives.

The Missouri, Kansas & Texas has ordered 5 mikado type locomotives from the American Locomotive Company, in addition to the 25 reported in the *Railway Age Gazette* of March 13.

The Mobile & Ohio has ordered 7 superheater consolidation type locomotives from the American Locomotive Company. These locomotives will have 24 by 30 in. cylinders, 63 in. driving wheels, a total weight in working order of 220,000 lb., and a steam pressure of 190 lb.

The Delaware & Hudson was reported in the *Railway Age Gazette* of last week as having ordered 15 consolidation and 10 Pacific type locomotives from the American Locomotive Company. The consolidation type locomotives will have 25 by 30 in. cylinders, 57 in. driving wheels, a total weight in working order of 256,000 lb., and a steam pressure of 185 lb. The Pacific type locomotives will have 24 by 28 in. cylinders, 69 in. driving wheels, a total weight in working order of 293,000 lb., and a steam pressure of 205 lb. All of the locomotives will be equipped with superheaters.

CAR BUILDING

The Union Pacific is in the market for passenger cars.

The Lehigh & New England has ordered 9 caboose cars from the American Car & Foundry Company.

The Denver & Rio Grande has ordered 500 gondola cars from the Pressed Steel Car Company.

The Missouri, Kansas & Texas has ordered 200 50-ton ballast cars from the American Car & Foundry Company.

The Chicago, Milwaukee & St. Paul has ordered 6 parlor and 2 cafe cars from the Barney & Smith Car Company.

The Red River Lumber Company, Westwood, Cal., has ordered 60 logging cars of 80,000 lb. capacity from the Seattle Car & Foundry Company, Seattle, Wash.

The Rutland has ordered 9 coaches, and 2 smoking and 3 baggage cars from the American Car & Foundry Company, and 3 combination baggage and smoking cars from the Standard Steel Car Company.

The Canadian Pacific has ordered 18 steel frame box, 2 caboose, one stock, one refrigerator and 2 all-steel mail and express cars from its Angus shops, and 40 all-steel Otis dump cars from the Canadian Car & Foundry Company.

IRON AND STEEL

The Chicago, Milwaukee & St. Paul has placed an additional order for 2,000 tons of rails with the Illinois Steel Company.

The Atchison, Topeka & Santa Fe has ordered 348 tons of steel from the American Bridge Company for metal work on the passenger station at San Diego, Cal.

Supply Trade News

The Prendergast Company, Cincinnati, Ohio, has moved its office to room 1210, Second National Bank building.

T. B. Bowman, a member of the sales force of the Q & C Company, has severed his connection with that company, effective May 12.

Paul Dickinson, Inc., has moved its offices from the Security building to 3346 South Artesian avenue, Chicago, and has discontinued its downtown office.

The Chicago, Burlington & Quincy has placed an order with the Locomotive Stoker Company for Street stokers to be used on 35 locomotives of the 2-10-2 type.

E. H. Barnes, southern representative of S. F. Bowser & Company, Inc., Fort Wayne, Ind., has severed his connection with that company, effective May 15.

Victor J. Shepard, for the past ten years chief draftsman of the Lima Locomotive Corporation, Lima, Ohio, has resigned from his position with that company.

The Carbo Steel Post Company, Inc., has enlarged its offices in the Rand McNally building, 538 South Clark street, Chicago, and now occupies rooms 881 to 887.

Sumner J. Collins, who has been associated for a number of years with the Rail Joint Company, with headquarters in Chicago, died in Chicago on April 30 following a brief illness. Mr. Collins was born at Oconomowoc, Wis., on March 24, 1848, and after learning telegraphy became, at the age of 15, night operator for the Chicago, Milwaukee & St. Paul. He remained with this company 28 years, advancing rapidly by promotion to various positions of responsibility in the operating department, and at the time he resigned to enter the manufacturing business he was superintendent of the Chicago & Milwaukee and the Chicago-Council Bluffs divisions of this road. He was engaged on the building of the extension from Ottumwa, Iowa, to Kansas City, Mo. In 1891 he again entered the railway service and for three years was general superintendent of the Chicago, Indianapolis & Louisville. Early in 1894 he became general superintendent of the Wisconsin Central, which position he held for nine years, after which he went to the Southern Railway as general superintendent of the Eastern division, comprising about 4,000 miles of main line. After a brief service with this company he became interested in the railway supply business.

S. J. Collins

Flint & Chester, Inc., New York, have been appointed selling agents for the National Graphite Lubricator Company, Scranton, Pa., for the East, including the railroads in the territory north and east of Buffalo and Baltimore.

At the meeting of the Council of the International Association for Testing Materials lately held in Turin, Italy, Robert W. Hunt, of Robert W. Hunt & Company, Chicago, was selected one of the vice-presidents of the association.

The New York U-S-L sales office and service station of the United States Light & Heating Company, Niagara Falls, N. Y., formerly located at 210 West Fiftieth street, has been transferred to the Locomobile building, 16 West Sixty-first street.

Louis H. Burns, who was formerly connected with the office of the motive department of the Chicago, Rock Island & Pacific, has been appointed western representative of the injector department of William Sellers & Company, Inc., Philadelphia. His office will be on the ninth floor of the Lytton building, Chicago.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company, Jersey City, N. J., on April 20, the retiring board of directors and Geo. T. Smith, president; George E. Long, vice-president; J. H. Schermerhorn, treasurer; Harry Dailey, secretary, and Albert Norris, assistant treasurer and assistant secretary were re-elected.

The Consolidated Boarding & Supply Company, 431 South Dearborn street, Chicago, has recently closed a contract with the Canadian Pacific to handle its boarding and commissary department on the Lake Superior division in connection with the heavy double tracking work which will continue for two or three years. This company's method of handling such work was described in the *Railway Age Gazette* of May 16, 1913.

Edwin J. Prindle and Arthur Wright, of the firm of Prindle & Wright, announce that Warren H. Small, formerly of counsel for Thomas A. Edison, Inc., and attorney for the Motion Picture Patents Company, and the General Film Company, has become associated with them under the firm name of Prindle, Wright & Small in the practice of law relating to patents, trade marks and copyrights. The firm's offices are in the Trinity building, New York.

Alexander B. Scully, president of the Scully Steel & Iron Company, died on May 7 at his home in Chicago. Mr. Scully was born in Chicago on November 29, 1856, and after attending the public schools, began his business career as a messenger boy. In 1875 he entered the employ of Joseph T. Ryerson, where he remained until 1885. In 1886 he formed the W. F. Mallory Company, which firm sold out to Joseph T. Ryerson & Son in 1890. In 1891 he formed the Scully-Castle Company, which later became the Scully Steel & Iron Company, of which he was president up to the time of his death.

TRADE PUBLICATIONS

LUBRICATORS.—The Detroit Lubricator Company has issued a booklet describing the Detroit Automatic Flange Lubricator and showing how it is used on various types of locomotives.

BORING AND DRILLING MACHINES.—The Betts Machine Company, Wilmington, Del., has issued a catalog which describes and illustrates the company's line of horizontal boring and drilling machines.

AUTOMATIC SCALES AND TANKS.—The Hamilton Scale & Tank Company has recently issued a catalog containing illustrations, brief descriptions and specifications of the company's line of automatic spring balance and springless counter sales and its automatic tanks for kerosene, gasolene, etc.

CORRUGATED CULVERTS.—The Pennsylvania Metal Culvert Company, Warren, Pa., has issued a very interesting booklet giving a brief history of the use of culverts and a statement of the excellencies of American ingot iron "Armco" corrugated culverts. There are also included several views of installations.

MOTOR CARS.—Mudge & Company have recently issued convenient pocket size folders containing a description of the Mudge-Adams inspection and one-man special motor car, and the Mudge-"Rysco" section motor cars. These cars are of various capacities and are particularly adapted for inspection and section work.

LOCOMOTIVE APPLIANCES.—Harry Vissering & Company, Inc., Chicago, have issued bulletin No. 97 describing several of the company's locomotive appliances among which are included: the "Viloco" and "Leach Type" locomotive sanders; the "Viloco" and "Improved Gollmar" bell ringer and various other "Viloco" products.

LOCOMOTIVE SUPERHEATERS.—The Power Specialty Company, New York, is issuing a catalog descriptive of the Foster Locomotive superheater. The booklet contains a view of the Pennsylvania locomotive on which the first Foster superheater was installed about two years ago, and plans of some of the various parts of the superheater itself.

Railway Construction

ANTHONY & NORTHERN.—An officer writes that the company will build at once an extension of about 12 miles, northwest from Iuka, Kan., towards Larned. The work involves handling from 15,000 to 20,000 cu. yd. to the mile, and will be carried out by the company's forces. The maximum grade will be 0.8 per cent. and the maximum curvature 3 degrees. The company now operates a 6-mile line from Iuka, south to Pratt.

CALDWELL COUNTY & SOUTHERN (ELECTRIC).—This company, which was recently organized with $100,000 capital to build from Hamilton, Mo., south to Kingston, about 10 miles, has secured the right of way, it is said, and will soon start construction work. F. L. Bowman and S. C. Rogers, Kingston, and D. Miller, Kansas City, are interested. (March 6, p. 492.)

CANADIAN NORTHERN.—The Gravelbourg sub-division of the Central division from Avonlea, Sask., west to Gravelbourg, 79.5 miles, was opened for traffic on April 2.

CANADIAN PACIFIC.—On the Weyburn extension, passenger service has been established on the line from Assiniboia, Sask., to Shaunavon, 118.3 miles. This extension forms part of the line which is being built across southern Saskatchewan and Alberta between Weyburn and Lethbridge. On the Foremost extension the line between Stirling, Alta., and Foremost has been opened, on 49.1 miles.

An officer writes that a contract has been given to G. H. Webster, Calgary, Alta., for grading a section of 25 miles on the Weyburn-Stirling branch, from a point 50 east of Stirling.

Work has been started by the Canadian Pacific double tracking the bridge over the Humber river at Lambton, Ont., on the London sub-division, and the double track between Leaside Junction and Agincourt is expected to be finished by June 1.

CARBON & STILLWATER (Electric).—An officer of this company, which was recently incorporated in Montana with $750,000 capital, writes that contracts will not be let to build the line until after August 1 of this year. The projected route is from Red Lodge, Mont., north to Willow creek, thence to the forks of the East and West Red Lodge creeks, and north to Columbus. The line will traverse a good farming section. L. C. Piper, president, Absarokee, Mont., and E. W. Draper, secretary. (April 3, p. 811.)

CHESAPEAKE & OHIO.—It is reported that this company has decided to abandon the plan to build an extension of the Hocking Valley from Jackson to Portsmouth, O., and will instead build a line of its own from Portsmouth to Columbus, connecting with the Hocking Valley, about 100 miles. It is estimated that the cost of such a line would be about $7,000,000.

CHICAGO, MILWAUKEE & ST. PAUL.—Freight service is now in operation on the line from Lewiston, Mont., northwest to Great Falls.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—The former Kaiser branch of the Northern division has been extended from Kaiser, Wis., to Park Falls, 5 miles. (November 28, p. 1047.)

EDMONTON, DUNVEGAN & BRITISH COLUMBIA.—See Edmonton, Dunvegan & Pacific.

EDMONTON, DUNVEGAN & PACIFIC.—Trains are now being operated by the construction department from a point five miles outside of the city limits of Edmonton, Alta., northwest via Campbell, Carbondale, Morinville, Jackson, Richland, Pickersville, Westlock, Debney, Boyd, Fawcett, Weir, Flatbush, Firland, Chisholm, Lyle and Presse to Smith, 130.5 miles. The Edmonton, Dunvegan & Pacific evidently is the same as the Edmonton, Dunvegan & British Columbia, which was reported some time ago as building from Edmonton, Alta., northwest via Dunvegan to Fort George, B. C.

FREDONIA & REEDS.—See Illinois Central.

ILLINOIS CENTRAL.—An officer writes that the Fredonia & Reeds has been incorporated to build from Fredonia, Ill., northwest to Reeds, 1.51 miles. The excavation work involves handling about 7,500 cu. yd., and there will be about 7,500 cu. yd. of embankment work to the mile.

KEOKUK, NAUVOO & FORT MADISON INTERURBAN.—Plans are being made, it is said, to build an electric line to connect Keokuk and Fort Madison, Iowa, and Nauvoo, Ill., Carthage and Hamilton. H. S. Payne, Fort Madison, is said to be interested.

LA SALLE TERMINAL RAILWAY.—Preliminary surveys are being made, it is said, to build a freight belt line from La Salle, Ill., via Oglesby to Granville. J. B. McCaffrey, president, Continental Bank building, Chicago, and R. Baldwin is engineer in charge.

LEHIGH VALLEY.—Work has been finished on the Seneca Falls branch from Seneca Falls, N. Y., east to Cayuga Junction, six miles, and the first train was recently run over the new line. (May 29, 1913, p. 1205.)

MEXICAN RAILWAY.—The reconstruction of the Huajuapam branch has been completed to Rosendo Marquez, 28 miles south of San Marcos, in the state of Puebla, Mexico, and train service is now in operation between these places.

MORGANTOWN & WHEELING (Electric).—An officer writes confirming the report that a contract was recently let to Keely Brothers & Gilmore, Morgantown, W. Va., to build an extension from Cassville northwest to Blacksville, 14 miles. The excavation work calls for handling an average of about 15,000 cu. yd. to the mile. The maximum grades on the extension will be 4 per cent. over one hill and 1.5 per cent. on the balance of the line, and the maximum curvature will be 16 degrees. There will be one steel bridge 160 ft. long and several small reinforced concrete trestles. The company now operates eight miles from Morgantown to Cassville. R. D. Hennen, chief engineer, Morgantown. (April 24, p. 966.)

NATIONAL RAILWAYS OF MEXICO.—The Guadalajara division has been extended from Zacapu, Michoacan, Mexico, south to Ajuno, 36 miles. (February 14, p. 313.)

NEW YORK SUBWAY.—The New York Public Service Commission, First district, has executed a contract with the Cranford Company for the construction of a section of the Eastern Parkway subway in Flatbush avenue between St. Marks avenue and Prospect Park plaza, borough of Brooklyn. The contract price is $2,225,519. (April 10, p. 856.)

OIL BELT TRACTION.—We are told that the prospects of building this line are good, and that the company expects to order rolling stock in October. The projected route is from Fort Smith, Ark., west to Shawnee, Okla., about 150 miles. The plans call for the construction of six steel bridges and four terminal buildings. The company was recently incorporated in Arizona with $5,000,000 capital and office at Oklahoma City, Okla., and expects to develop a traffic in passengers, coal, oil and ore. In addition to the use of steam as the motive power, electricity will be used. (May 1, p. 1011.)

OREGON SHORT LINE.—An officer writes that a grading contract was recently given to the Utah Construction Company, Ogden, Utah, to build under the name of the Snake River Belt Line, a new line in the Upper Snake river valley, Idaho. The plans call for building from the northern terminus of the Menan branch at Menan, northeast on the west side of the North Fork of Snake river to a point on the Yellowstone branch immediately south of St. Anthony and from the same branch at a point just north of St. Anthony southeasterly to a point about two miles east of Lincoln, from which place a short line connects with the Yellowstone branch at Lincoln, in all about 71.5 miles. There will be four steel bridges over the two forks of the Snake river, with a combined length of 1,100 ft. Most of the route is along the Snake river valley, which is a level lying plain, with a fall from north to south of only about 7 ft. to the mile. A portion of the line will be somewhat higher than the elevation of the Snake river valley and this section will have a maximum grade of 1 per cent. The territory is already served by the existing line, but the new line is being built to better serve the non-irrigated territory lying to the east of the irrigated land between Idaho Falls and St. Anthony. In no instance will the new line be further than 10 miles in a direct line from an existing road.

QUEBEC CENTRAL.—An extension of this road from St. Sabine, Dorchester county, Que., to English Lake, also called Lac La

Frontier, 25 miles, has been surveyed and located, and 10 miles of the line from St. Sabine to a point five miles east of St. Camille is under construction and is expected to be finished during 1914. The remaining 15 miles will probably be built and the line put in operation by the end of 1915. The route follows the water shed of the St. John river, and is close to the boundary line between the province of Quebec and the state of Maine.

Rolla, Ozark & Southern.—This company, which was recently incorporated in Missouri with $200,000 capital, has let a contract, it is said, to build from Rolla, Mo., south to Anutt, 18 miles. J. E. Walker, general manager and secretary. The headquarters of the company are at Rolla, and the incorporators include J. A. Frank, Anutt, and E. W. Walker, Rolla. (May 1, p. 1012.)

San Antonio, San Jose & Medina Valley Interurban.—An officer writes that contracts are to be let soon to complete a line from San Antonio, Tex., southwest via San Jose to Kirk, about 20 miles. The company now operates about three and a half miles of electric lines. There will be a 100-ft. steel bridge on the line. A. D. Powers, president, San Antonio. (May 1, p. 1012.)

Snake River Belt.—See Oregon Short Line.

Tampa & Gulf Coast.—This company is now operating between Tampa, Fla., and Clearwater, 33 miles. The Elfer's branch from Tarpon to Port Richey has been opened for business. (March 27, p. 767.)

Van Horn Valley.—A contract has been let by this company, it is said, to build a section of this line, and the work is to be started at once. The company was chartered about a year ago, and plans to build from Van Horn, Tex., north to the Texas-New Mexico state line, about 75 miles. The incorporators include J. M. Daugherty, J. Y. Canon, and J. Irby, all of Van Horn. (September 5, p. 436.)

RAILWAY STRUCTURES

Albany, N. Y.—An officer of the New York Central & Hudson River writes that the work being carried out at Albany, to eliminate a grade crossing at North Pearl and Van Wert streets on the main line, Mohawk division, includes straightening the railroad alinement by replacing a reverse curve with tangent affecting about 1,600 lineal feet of four track roadbed. Detouring North Pearl street, and carrying it under the railroad in a subway about 400 feet northerly of present grade crossing, with an approach on west of Van Wert street and a high level approach to Dudley avenue, carrying it over the Van Wert street approach by a concrete arch, and the construction of a pedestrian subway just southerly of the present grade crossing. The substructural work calls for about 50,000 cu. yd. of excavation, 7,000 cu. yd. of concrete, 9,000 sq. yd. macadam and stone block pavement, and 34,000 sq. ft. of sidewalk. This work was let recently to the Walsh Construction Company, Davenport, Iowa, on a unit price basis, the estimated cost being approximately $128,000. The railroad bridge over the subway will consist of a 340-ton steel plate girder bridge. The manufacture and delivery of the steel was let to the Fort Pitt Bridge Works, and the erection and water-proofing of the steel bridge to the Jobson-Gifford Company. The railroad company will make the change in its tracks and signals and will support the track during the construction of the subway.

Baton Rouge, La.—Work will be started in July by the Louisiana Railway & Navigation Company on a one story brick station at Baton Rouge. The new structure is to be 35 ft. by about 120 ft. No bids will be asked for the work.

Chicago, Ill.—On May 5 the Union Station Company filed a petition with the Illinois Public Utilities Commission, asking an order granting permission to the company to accept the ordinances for the new passenger terminal in Chicago. The commission has set May 14 as the date for the hearing.

Troy, N. Y.—Work will be carried out at once by the New York Central & Hudson River rebuilding bridges crossing the right of way of the Troy Union Railroad in Troy. The cost of the improvements will be between $40,000 and $45,000.

Railway Financial News

Chesapeake & Ohio.—*The Wall Street Journal,* in discussing the possibilities of the continuance of dividends at the present rate of the Chesapeake & Ohio, points out that the company is carrying 2,500 shares of Western Pocahontas Corporation stock at a valuation of $250,000 in its securities owned, and $750,000 4½ per cent. bonds of this corporation are guaranteed by the Chesapeake & Ohio. Interest payment on these bonds is made through the sale of timber on the 30,000 acres of coal lands which this corporation owns. *The Wall Street Journal* points out that this coal land is carried on the books at the nominal value of $8 an acre, whereas it is presumably worth a great deal more than this.

It is reported that a firm of English bankers have agreed to underwrite the entire bond issue necessary to build the newly proposed extension to connect the Chesapeake & Ohio with the Hocking Valley.

Chicago & North Western.—Kuhn, Loeb & Company have bought from the railroad $8,000,000 general mortgage 4 per cent. bonds. The bankers are offering the bonds to the public at 94½.

Chicago, Rock Island & Pacific.—The report of E. W. McKenna, vice-president of the Chicago, Milwaukee & St. Paul, has in part been made public.

Mr. McKenna estimates the needs of the property in the next five years as $65,000,000, to be expended as follows:

Additions and betterments	$41,688,000
Deferred maintenance to track and equipment	8,896,000
New equipment	15,000,000

In the second part of the report, which partially revises some of the original findings under the head of "prospective capital requirements," it is stated that in the next three years $31,000,000 will be needed as follows:

Year ended June 30, 1915	$8,000,000
Year ended June 30, 1916	8,000,000
Year ended June 30, 1917	12,000,000
Payment 20 per cent. on $15,000,000 new equipment	3,000,000
Total	$31,000,000

Outlining the operating economies which the expenditure of $65,000,000 is expected by Mr. McKenna to reduce, the report says: If the sum of $65,000,000 is applied certain economies will be produced and an improvement in the present property will be secured which will put a stop to deterioration and place the property in such physical condition as to secure a great proportion of the traffic of the country it serves.

There are about 20,000 cars which should be retired, but possibly 4,000 of these are in such condition that their life can be extended for from two to five years. This would mean a retirement of 16,000 cars, and investment of $15,000,000 in 15,000 new cars would produce an efficiency of equipment at least 50 per cent. greater than had with the cars retired.

The maintenance cost of these new cars for the first five years should not exceed $25 per car per year. In the tabulation of prospective capital requirements there is an estimated saving operation of $4,400,000 per annum.

It is assumed further that the improved conditions of the railway and its equipment would produce an increase of revenue over existing conditions of at least $5,000,000 per annum, of which 30 per cent. would be net earnings. The investment of this money would also enable the company to carry on its maintenance program from January to July, which would yield a saving of at least $500,000 per annum.

A statement of these matters would be about as follows:

16,000 cars retired at $79 expense for maintenance per annum	$1,264,000
Less maintenance of 15,000 new cars, $25 per annum	375,000
Net equipment maintenance saving	889,000
Saving resulting from investment of $41,000,000	4,435,494
Total	$5,324,494
Net earnings $5,000,000 new business at 30 per cent.	1,500,000
Saving in maintenance cost due to applying expense of maintenance of way and structures and equipment during the spring months	500,000
Total	$7,324,494

"The construction of the short line from Chicago to Kansas City by way of Peoria, Ill., and Keokuk, Ia., will have the most potent effect in reducing transportation expenses and in addition to the other advantages discussed previously in the report, should reduce the ratio of transportation expenses to gross earnings to some point between 35 and 37 per cent. There is very little doubt that this improvement would place the whole property in a condition of such increased efficiency in its operations that sufficient earning power would be developed to restore the stock of the railway company to at least its par value, and it is within the possibilities that it could be raised to such a value, say at the end of five years, as to enable the company to take care of some of its future financing through the sale of common stock."

Mr. McKenna's report was divided into two parts. The first part put the road's needs at $65,000,000, while in the second part Mr. McKenna sets his total figure at $31,000,000 under the head of "prospective capital requirements." The second part provides only for three years, while the first part considers five years. The difference in the estimates of the two parts of the report was caused by considering three years instead of five, by counting only the cash payment required for new equipment, which cuts the total down $12,000,000, and by figuring that increased prosperity would take care of the "deferred maintenance" charge.

Mr. McKenna says the prospects of the prosperity of the company had been greatly increased since he wrote the first part of the report. This localized prosperity should increase net income for the next fiscal year by $2,000,000, and if ordinary conditions of prosperity continue through the period of 1916 Mr. McKenna believes that 75 per cent. of the deferred maintenance will be taken up within the next two fiscal years.

Mobile & Ohio.—Stockholders are to be asked at a special meeting, July 14, to authorize a new mortgage securing $50,000,000 bonds and $3,000,000 three year notes to be secured by a like amount of the new bonds.

Missouri Pacific.—The directors asked Kuhn, Loeb & Company to finance the refunding of the $25,000,000 collateral notes which mature June 1; the bankers, however, have declined. The bankers' letter to the Missouri Pacific directors is in part as follows:

"We have had an examination made by experts into the physical and financial condition of the Missouri Pacific and the St. Louis, Iron Mountain & Southern Railway companies, and we have also had a conference with B. F. Bush, the president of your company, who with entire frankness has explained to us present conditions regarding your company as he views them and its requirements for the next few years, aside from the provision which need now be made for the maturing notes.

"The report of our expert upon the physical condition and operation of your properties is favorable and reflects much credit upon President Bush's management. On the other hand, from the accountant's report, it appears, taking into consideration the depreciation charges required under the rules of the Interstate Commerce Commission and various other items, which, beginning with the coming fiscal year, will very consideraly increase the charges against income, that the fixed charges resting upon the Missouri Pacific system have become decidedly too heavy, both in relation to earnings and in proportion to the equity represented by the amount of stock outstanding.

"From the information before us it appears that, in order to meet maturing equipment and other obligations, to purchase greatly needed additional equipment, and to keep its lines in proper physical condition, the company must be assured for the next two years of at least $10,000,000 in addition to the $25,000,000 required for the payment of its maturing notes, or a total of at least $35,000,000.

"It appears further that within the next three years about $20,000,000 of bonds are falling due, and within the following four years more than $30,000,000, or a total of over $50,000,000 (the separate liens of most of which must not be extended, in accordance with the provision of the existing refunding mortgage), apart from the annual requirements for improvements, etc., and such other expenditures as may be imposed by legislative enactments or local ordinances.

"It seems to us quite manifest that the $35,000,000 now required ought not to be obtained in any manner which would increase existing fixed charges, but, on the contrary, that a reduction of the volume of such charges is imperatively called for in the best permanent interest of your property and its stockholders. We are satisfied that unless a substantial amount of new funds is furnished without involving the payment of fixed charges, and unless a broader and more stable basis of permanent credit is created, your properties will not be able to do justice either to themselves or to the needs of the growing business and traffic tributary to them.

"To carry these suggestions into effect would necessarily take more time than the three weeks now remaining before the maturity of the $25,000,000 notes, and without the realization of these remedial steps and certain other measures being assured, we cannot see our way to undertake the requisite financing.

"It is the judgment of the experts we have employed that with the consummation of the financial and other measures referred to, the Missouri Pacific and Iron Mountain Railroads, granted fair and reasonable rates, should, with their natural advantages and under efficient management, attain stable and assured prosperity and the good-will and enhanced patronage of the people in the territories served by these lines."

The Wall Street Journal says:

"It is understood that one of the features of the proposition made by Kuhn, Loeb & Company involved the placing of a majority of the stock in a voting trust which would mean the practical elimination of the Goulds from the management. The acceptance or rejection of this plan will depend absolutely upon George J. Gould, but why this should be so remains a mystery inasmuch as Gould and the Gould estate are known to have disposed of their stock. Wall Street believes it would be an easy matter to secure a majority representation of the stockholders in favor of a new management, if deposit of stock were solicited."

The directors have requested holders of the notes to extend these notes for one year at 6 per cent., the company agreeing to deposit in addition to the present collateral $3,000,000 St. Louis, Iron Mountain & Southern notes. Holders of the notes are asked to deposit the same with the Union Trust Company of New York before May 25.

New York, New Haven & Hartford.—During the week hearings have been going on before the Interstate Commerce Commission in regard to the relations of the New York, New Haven & Hartford and the Boston & Maine, and of the New Haven and individuals. Testimony was given as to the payment for various legal services, and John L. Billard testified as to the purchase of Boston & Maine stock. The substance of Mr. Billard's testimony was that he bought largely on borrowed money 109,948 shares of Boston & Maine stock in 1907, at 125, which at that time was about the market price of the stock, and after the Massachusetts legislature had incorporated the Boston Railroad Holding Company he sold to this company the Boston & Maine stock at 150 a share, making a profit of about $25 a share on 109,948 shares. At the time of the purchase of Boston & Maine stock Mr. Billard testified that he was not a director of the New York, New Haven & Hartford.

Northern Pacific.—No announcement was made after the directors' meeting as to the plans for a refunding mortgage, which plans it is understood have been under consideration.

Southern Pacific.—The bonds remaining with the syndicate—about $16,000,000—which were not taken by the stockholders have all been sold by the syndicate. (See *Railway Age Gazette* of May 8, page 1056.)

Wabash.—Winslow S. Pierce, chairman of the bondholders' committee of the Wabash, has notified the chairman of the Missouri Public Service Commission that plans for the reorganization of the company will be ready in about two weeks.

Railway Construction in Sumatra.—The Deli Railway Company of Sumatra has obtained a concession for the construction of a line of railway from Tebing Tinggi to Dolok Merawan, and for a line from Dolok Merewan to Pematang Siantar, the capital of Similoengoen. The company has already begun the work at Tebing Tinggi, and will push operations. The extension of tea planting in the Siantar regions has been partly waiting until the latter concession should have been granted.